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Residential Ventilation using Section 9.32 of the Ontario Building Code Manual

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RESIDENTIAL VENTILATION USING SECTION 9.32 OF THE 2012 ONTARIO BUILDING CODE

Second Edition (2021 Edition)

NOTES

FOREWORD

The Canadian Edition of the Residential Mechanical Ventilation Manual OBC 9.32 has been developed and published by the Heating, Refrigeration and Air Conditioning Institute (HRAI) of Canada. Reproduction in any form, whether written, electronic or mechanical, is forbidden.

The careful use of this manual should result in the satisfactory design and installation of Residential Mechanical Ventilation Systems. However, the end result is in no way warranted by either the Heating, Refrigeration and Air Conditioning Institute of Canada or any companies or any persons involved in the preparation or presentation of this manual.

First Edition

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Heating, Refrigeration and Air Conditioning Institute of Canada

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Air King

Aldes Canada

Broan-Nutone

Fantech

Lifebreath

Reversomatic

Thermolec

VanEE

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PURPOSE

The Residential Mechanical Ventilation Manual 2012 Ontario Building Code 9.32 is intended to instruct members of the heating, ventilating and air conditioning industry in the proper design and installation of residential mechanical ventilation systems according to the Ontario Building Code 2012 Section 9.32.

The manual is meant for industry personnel who have a good basic understanding of HVAC equipment and ductwork installation. The manual does not cover depressurization testing, balancing, or ventilation equipment testing.

SCOPE

a) The materials in this manual are designed for Residential Mechanical Ventilation Systems, including those with and without heat recovery.

b) The duct sizing section of this manual is designed for systems having air velocities and air volumes typical of residential ventilation systems and should not be used to size ducts for residential heating or cooling systems.

c) This manual is not intended to be used in designing, installing or commissioning commercial ventilation systems.

d) The worksheets incorporated within the manual are to be used for the purpose of designing, residential mechanical ventilation systems.

e) The equipment specifications contained within this manual are generic in nature, and although they are representative of actual equipment, they may be considerably different when compared to a particular appliance in the field. **Therefore, the specifications supplied by the equipment manufacturer must be used for actual designs.**

f) The codes and standards used to compile this manual are written in metric. HRAI has included imperial units for the convenience of the participants.

   i. In the case of volume conversions for Litres per second (L/s) to cubic feet per minute (cfm), HRAI has used a soft conversion of 1 L/s = 2 CFM, which will provide reasonable accuracy in most situations. Participants should be aware that some jurisdictions may use a hard conversion, commonly 1 L/s = 2.118 CFM or 1 CFM = 0.47 L/s.

   ii. In the case of pressure conversions for Pascals (Pa) to inches of water column (" w.c.) HRAI has used a soft conversion of 250 Pa = 1" w.c. Participants should be aware that some jurisdictions may use a hard conversion, 249 Pa = 1" w.c. Also, for the purpose of this document, water column has the same meaning as water gauge (w.g.).

OBC History[1]

Heating Season Mechanical Ventilation

For many years, houses were constructed without mechanical ventilation systems. They relied on natural air leakage through the building envelope for winter ventilation. However, houses have become progressively more airtight through the introduction of new products and good practices, e.g. the substitution of plywood for board sheathing, the replacement of paper-backed insulation batts with friction-fit batts, polyethylene films, improved caulking materials, and tighter windows and doors.

Following the energy crisis in the early 1970s, considerable emphasis was placed on reducing air leakage in order to conserve energy. Electric heating systems were encouraged, and higher efficiency furnaces were developed, which further reduced air change rates in buildings. This led to concerns that the natural air change in dwelling units might be insufficient in some instances to provide adequate indoor air quality. Condensation problems resulting from higher humidity levels were also a concern.

Evolution of OBC Ventilation Requirements

Mechanical ventilation requirements in the OBC have evolved from a simple requirement in the 1983 edition that exhaust fans be incorporated in electrically heated houses. The 1986 and 1990 editions required that all houses have mechanical ventilation systems capable of exchanging the indoor air for outdoor air at a specified rate:

- 0.5 air changes per hour in the 1986 edition and
- 0.3 air changes per hour in the 1990 edition.

The 1997 OBC addressed not only the overall air change rate created by the mechanical ventilation system but also the need to ensure

[1] This is an excerpt from the 2012 OBC Appendix material.

that the outdoor air brought into the house by the system is distributed throughout the house.

Current Requirements

The ventilation systems described herein are essentially the same as those described in the 1997 OBC, but additional provisions have been included with the following goals in mind:

- provisions that are easier to understand,
- the reduced probability that outdoor air distributed through a forced-air heating system will be cold enough to cause premature deterioration of the furnace heat exchanger

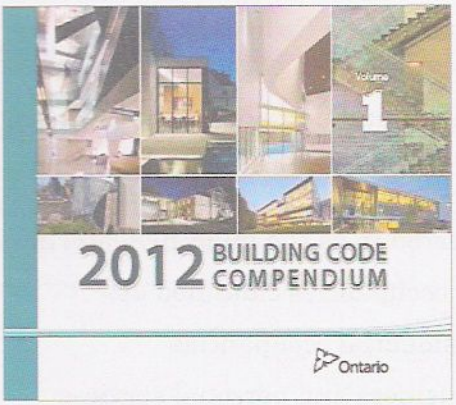
SB-12 Energy Efficiency Requirements

The first edition of "MMA Supplementary Standard SB-12: Energy Efficiency for Housing" was published in 2009 to provide design options regarding the energy efficiency of a house or a part of a residential building that is within the scope of Part 9, that is intended for continued occupancy during the heating season.

The intent of the SB-12 standard is to recognize the needs of consumers and the building industry for predictable prescriptive and flexible performance-based solutions for energy efficiency compliance.

SB-12 was referenced in Ontario's Building Code and came into effect in January 2012. Since then, the SB-12 standard went through a number of updates to reflect advances in building construction practices, materials, and HVAC equipment efficiency.

OBC 2012 CODE GUIDE



This code guide intends to provide designers with an easy to use outline that can be used to design and install a ventilation system under Section 9.32 of the Ontario Building Code.

Following the prescriptive requirements outlined in the guide should provide a ventilation system that will perform well.

As this is an HRAI interpretation of the Ontario Building Code Part 9, Section 9.32, the reader should refer to the code itself for precise definitions of the requirements.

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Scope of Part 9

NOTE: A sentence or paragraph in a two-line text box is an HRAI explanation of the intent of the OBC.

NOTE: The building area of a house (as per Part 9) is the footprint area projected onto the ground, measured using the exterior perimeter. The total house floor area may be much greater.

OBC 1.4.1.2 Defined Terms
Dwelling unit means: a suite operated as a housekeeping unit, used or intended to be used by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

NOTE: the OBC defines a "house" as,

- detached house,
- semi-detached house,
- row house

containing not more than two *dwelling units*.

NOTE: The ventilation system used in a second dwelling unit must conform to the rules of a heating season ventilation system.

1.1.2.4 Application of Part 9

Part 9 of the Ontario Building Code (OBC) applies to specific sizes and types of buildings that are limited to:

- 3 storeys or less in building height not including the basement,
- less than 6,460 sq.ft. (600 sq.m.) building area sometimes referred to as the building footprint,
- used for major occupancies classified as;

  (i) Group C, residential occupancies

  (ii) Group D, business and personal services occupancies

  (iii) Group E, mercantile occupancies, or

  (iv) Group F, Divisions 2 and 3, medium hazard industrial occupancies and low hazard industrial occupancies

A ventilation system for a building that does not meet all of these requirements (i.e. multi-family structures more than 3 storeys) must be designed using OBC Part 6 (e.g. CAN/CSA-F326-M, "Residential Mechanical Ventilation Systems" as explained in HRAI's Residential Ventilation using F326 training course).

If a ventilation system serves more than one dwelling unit such as hotels, nursing homes, dormitories, or jails (a house with two dwelling units is the exception), the ventilation system must be engineered (e.g. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality).

Note: A house, as defined under the OBC, can contain two dwelling units, so a ventilation system designed to this code guide can be used for a house with two dwelling units.

The building area is measured to firewalls, so multiple Part 9 buildings may be joined together as long as an appropriate fire-rated separation is provided between each Part 9 portion of the entire building.

9.32.1 General

9.32.1.1 Application

NOTE: Some good practices have been included in this manual and are highlighted by a single-line text box to differentiate them from strict code requirements.

Section 9.32 applies to the ventilation of rooms and spaces in residential occupancies by natural ventilation and to self-contained mechanical ventilation systems serving only one house or dwelling unit.

Mechanical ventilation systems, other than self-contained systems serving a house or single dwelling units, shall conform to Part 6.

Ventilation of all other occupancies (e.g. small commercial buildings) shall comply with Part 6 (e.g. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality).

In order to be considered part of the residential occupancy, and not require its own ventilation system, a storage garage capacity is limited to no more than 5 vehicles.

A clothes dryer exhaust duct system shall comply with Part 6 or Article 9.32.1.4.

9.32.1.2 Mechanical Ventilation for Dwelling Units

All houses and dwelling units supplied with electricity shall have a mechanical ventilation system. Natural ventilation may still be required in some rooms if mechanical ventilation is not provided at an adequate rate.

9.32.1.3 Ventilation of Rooms and Spaces

NOTE: A window or door located in a room would represent natural ventilation.

Every room shall have natural ventilation unless it has mechanical ventilation.

Where a room or space is not provided with natural ventilation, mechanical ventilation shall be provided;

- in a room or space that is mechanically cooled, "mechanical ventilation" (exhaust or supply) shall be provided at the rate of 1/2 air change per hour.
- in a room or space that **is not** mechanically cooled, "mechanical ventilation" (exhaust or supply) shall be provided at the rate of 1 air change per hour.

Note: An example of this would be a room in the middle of a house with no windows or doors open to the outdoors. This room would still require ventilation at a rate not less than listed above.

9.32.1.4 Venting of Laundry-Drying Equipment

Dryer exhaust ducts shall:

- discharge directly to the outdoors,
- be independent of other exhaust ducts,
- be accessible for cleaning, and
- ducts and piping located within the wall assembly shall be constructed of smooth corrosion-resistant material and not the often-used flexible ducting used to connect the drying equipment.

Where multiple dryers are connected to a common venting system, the exhaust duct system shall:

- be connected to one central exhaust fan and one central lint trap,
- be wired such that turning on any dryer will activate the central exhaust fan, and
- provide make-up air as required by 9.32.3.8.

9.32.2 Natural Ventilation

9.32.2.1 Natural Ventilation Area

Natural ventilation can be provided by an unobstructed, openable ventilation area (e.g. a window or door). The minimum ventilation area must conform to Table 9.32.2.1.

Natural Ventilation Table 9.32.2.1

Location	Minimum Unobstructed area
Bathrooms or water closet rooms	0.97 ft^2 (0.09 m^2)
Unfinished basement spaces	0.2% of the floor area
All other finished rooms	3 ft^2 (0.28 m^2) per room or combination of rooms

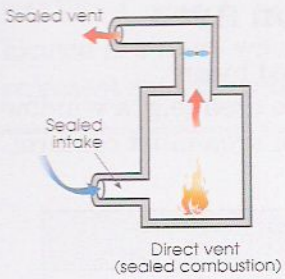
A vestibule may be used to provide ventilation to a room directly open to it.

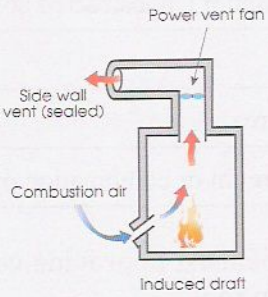
9.32.2.2 Protection from Weather and Insects

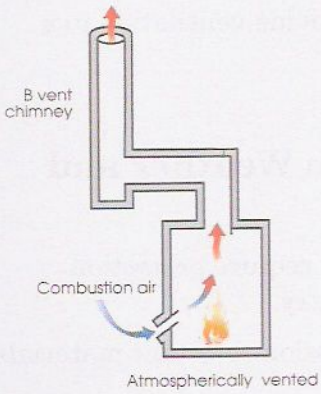
Openings other than windows require protection against weather and insect entry.

Screens shall be made of corrosion-resistant materials.

9.32.3 Mechanical Ventilation







NOTE: The wording used in **Type I** was to include appliances in a service room that is not part of the dwelling unit (e.g. in the building, but not necessarily in the dwelling unit).

9.32.3.1 General

The Ontario Building Code (OBC) states a non-solid fuel-fired appliance shall be classified as:

- direct vented whereby the combustion air is supplied directly from the outdoors to the combustion chamber via a sealed passageway and the products of combustion are exhausted directly outdoors through an independently sealed vent,
- mechanically vented induced draft whereby combustion air is supplied from within the building envelope, and the products of combustion are exhausted directly to the outdoors by means of a dedicated sealed vent, or
- natural draft whereby combustion air is supplied from within the building envelope and the products of combustion are exhausted directly to the outdoors through a chimney or B-Vent relying on thermal buoyancy.

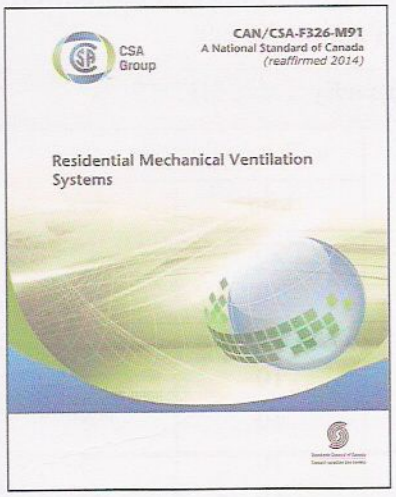
OBC Section 9.32 defines 4 types of dwelling units based on the type of combustion equipment in them:

- **Type I:** All fuel-fired combustion appliances serving a dwelling unit are direct vented or, mechanically vented induced draft (excluding mechanically vented fireplaces),
- **Type II:** All **Type I** houses with a solid fuel appliance,
- **Type III:** Natural draft appliances, including induced draft appliances connected to chimneys (i.e. type B Vents),
- **Type IV:** Electric Space Heat.

Note: A **Type IV** house (electrically heated) are considered non-spillage susceptible and are therefore the same as a **Type I** house.

Note: A **Type IV** house with a wood stove is considered to be the same as a **Type II** house.

9.32.3.2 Required Mechanical Ventilation



The mechanical system required for a house with electrical power shall comply with:

- Part 6 (e.g. CAN/CSA-F326-M, "Residential Mechanical Ventilation Systems" as explained in HRAI's Residential Ventilation using F326 training course), or
- The prescriptive requirements for a Type I, Type II, or Type IV dwelling unit as described throughout this manual.

Type III dwelling units must have their ventilation systems designed under Part 6.

Note: Although it is not specifically written in the OBC, houses or dwellings are limited to 5 bedrooms. The tables for sizing the ventilation system are limited to dwelling units with 5 bedrooms, therefore, dwelling units with more than 5 bedrooms must be designed according to Part 6. (e.g. CAN/CSA-F326-M, "Residential Mechanical Ventilation Systems" as explained in HRAI's Residential Ventilation using F326 training course).

9.32.3.3 Total Ventilation Capacity

The minimum total ventilation capacity (TVC) of the ventilation system shall be the sum of the individual room capacities given in Table 9.32.3.3

"Total Ventilation Capacity" (TVC):

- 20 cfm for the master bedroom,

-plus-

- 20 cfm for unfinished basement areas,

-plus-

- 10 cfm for all other habitable rooms.

NOTE: If a ventilation system serves a house with two dwelling units then there must be two master bedrooms.

Total Ventilation Capacity Table 9.32.3.3

Room	Capacity	
	cfm	L/s
Master bedrooms[1]	20	10
Other bedrooms	10	5
Living Room[2]	10	5
Dining Room[2]	10	5
Kitchen	10	5
Family Room[2]	10	5
Recreation Room	10	5
Basement area[3]	20	10
Other habitable rooms[4,5]	10	5
Bathroom or Water Closet	10	5
Laundry room	10	5
Utility Room	10	5

Notes:

1) At least one bedroom in each dwelling shall be designated as the master bedroom.
2) Combined rooms (e.g. living/dining) shall be allowed for as if each space were an individual room.
3) Where the basement incorporates habitable rooms, each room shall be assigned airflow according to the room use.
4) Where a basement room exceeds 2/3 of the total basement floor area, it shall be assigned 20 cfm (10 L/s).
5) Habitable rooms do not include rooms intended solely for access, egress, storage or service equipment.

9.32.3.4 Principal Exhaust

The principal ventilation exhaust fan(s) must be capable of operating at an exhaust airflow capacity complying with Table 9.32.3.4.A.

"Principal Exhaust Fan Capacity" (PEFC):

- 30 cfm for the master bedroom,

-plus-

- 15 cfm for each additional bedroom.

NOTE: For the purpose of this code guide, HRAI has used soft conversion factor to come up with 60 cfm (= 30 L/s) but a designer may be required to use 64 cfm based on hard conversion under certain circumstances

Principal Exhaust Fan Capacity Table 9.32.3.4.A

Number of Bedrooms	Capacity	
	cfm	L/s
1	30	15
2	45	22.5
3	60	30
4	75	37.5
5	90	45
More than 5	Part 6 Design	

Principal Ventilation Exhaust Fan(s)

The principal ventilation exhaust fan can be:

- a single exhaust fan,
- the exhaust side of an HRV/ERV, or
- two or more exhaust fans controlled simultaneously.

The principal ventilation fan shall have a manual switch located in the central living area of the house marked "VENTILATION FAN."

If the principal ventilation exhaust fan is controlled by a dehumidistat or other automatic control, then a manual switch (or override) shall be capable of turning the principal ventilation fan ON regardless of the setting of the automatic control.

When the capacity of the principal exhaust fan exceeds the required airflow by more than 50%, it shall have a control device that is capable of reducing the airflow to within ±10% of the principal exhaust fan capacity (PEFC). This control could be any device that has more than one speed.

Refer to **Figure 1** on p10.

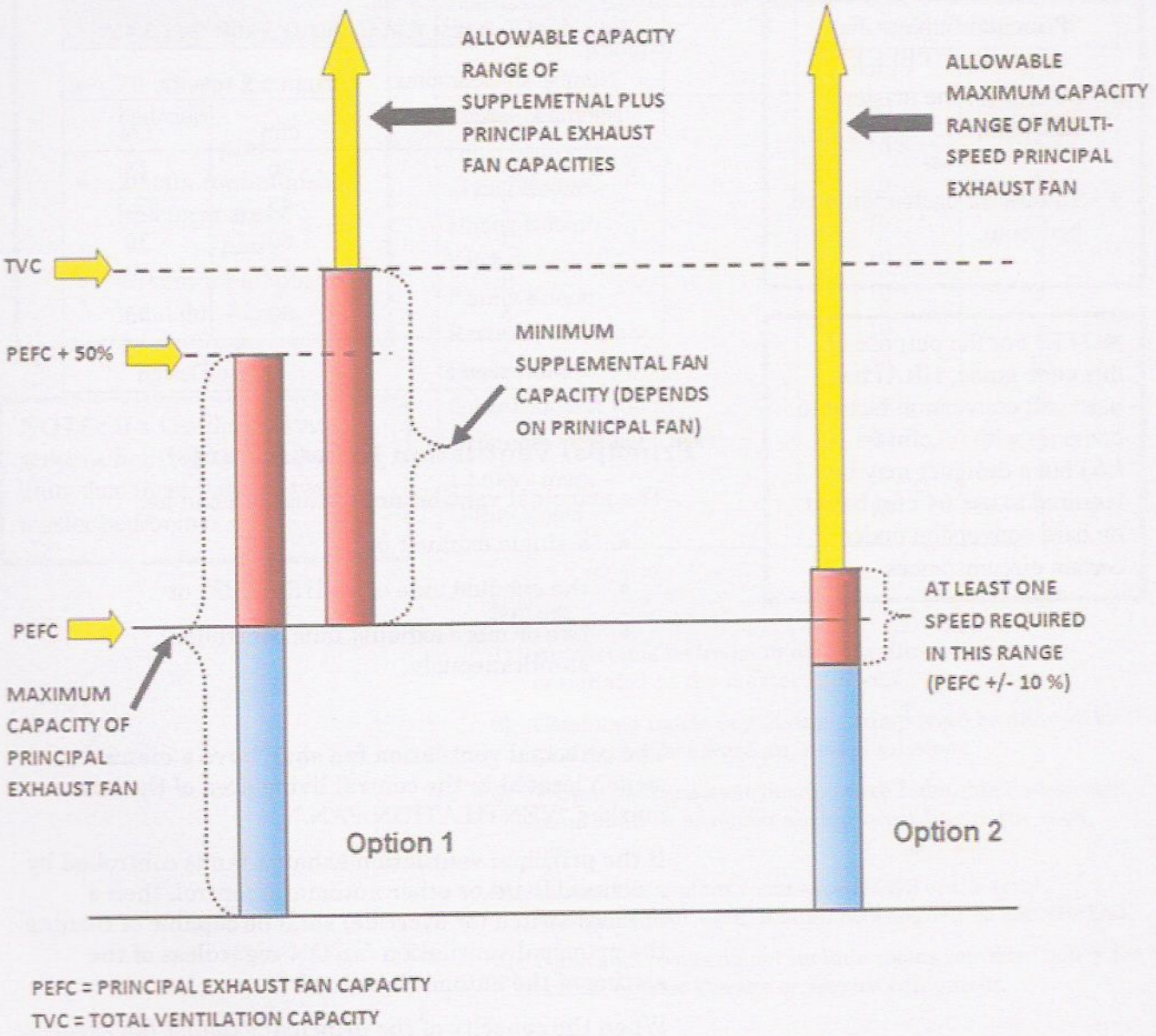
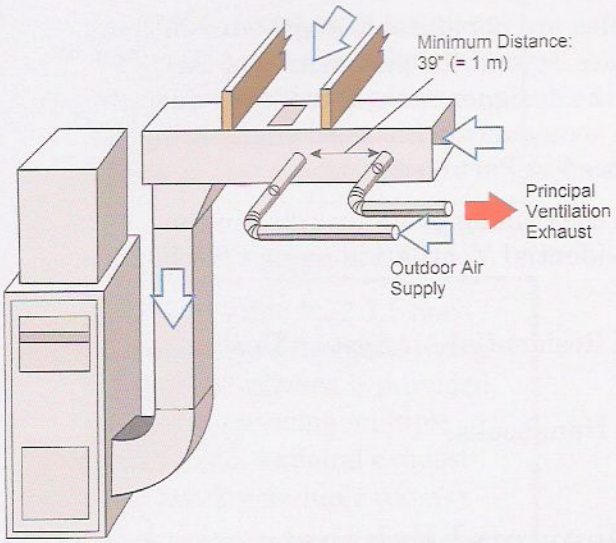


Figure 1: Principal Ventilation Exhaust Fan(s) Compliance Options



When a principal ventilation exhaust duct is connected to a forced-air HVAC system, it must be:

- located on the return duct of the forced air HVAC system, and
- be 39" (1 m) upstream from the outdoor air supply duct connection.

Principal ventilation exhaust fan air intakes located in kitchens shall be located in the ceiling or in the wall within 12" (300 mm) of the ceiling.

Ducts servicing the principal exhaust fan that do not exceed 39' (12 m) in length from intake grille to the outdoor hood and having no more than 4 elbows can be sized using Table 9.32.3.4.B.

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Notes:

1) The duct shall always be at least as large as recommended by the manufacturer.
2) If flexible ducting is used, it shall be increased by 1" (25 mm).
3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm).
4) Where the principal exhaust fan (PEF) is connected to the return air system of the forced air heating system, the exhaust duct shall be increased by 1" (25 mm).

Note: Although it is not specifically written in the OBC, Table 9.32.3.4.B should be used for the supply side of an HRV/ERV when used as a principal fan and connected to a forced air system.

Where these tables are not suitable (e.g. bedroom count or duct lengths are beyond the parameters of the chart), or when the designer chooses too, then ducts shall be sized in accordance with "good engineering practice" referenced in Part 6 such as:

- the HRAI duct sizing guide included in the HRAI Residential Ventilation using CSA F326 Manual,
- the HRAI Residential Air System Design Manual,
- ASHRAE Handbooks.

9.32.3.5 Supplemental Exhaust

Supplemental exhaust may be required in order to satisfy the total ventilation capacity (TVC) requirement. The balance of exhaust must be equal to, or greater than the difference between the total ventilation capacity (TVC) and the principal exhaust fan capacity (PEFC).

Supplemental Exhaust is not required when

- the principal fan is large enough to meet the TVC requirement,
- the principal fan is capable of reducing the airflow to within ±10% of the PEFC requirement, and
- principal exhaust air inlets are installed in each kitchen, bathroom and water closet.

Exhaust air intakes must be provided in each kitchen, bathroom and water closet.

NOTE: The OBC does not specify exhaust air capacities (cfm) for these rooms, however, CSA F326 provides values that can be considered as good practice.

NOTE: In this Code Guide, the more common term "Range Hood" may be used and should be interpreted as a cooking appliance exhaust fan serving a cooktop.

Where an intake for a supplemental exhaust fan other than a cooking appliance exhaust fan serving a cooktop is installed in a kitchen, it shall be installed in the ceiling or in the wall within 12" (300 mm) from the ceiling.

NOTE: No specifics are given around this measured length, but good practice suggests measuring from the outdoor hood to any exhaust inlet.

NOTE: Table 9.32.3.5 may also be used for branch sizing where the exhaust is provided by a fan servicing multiple rooms (i.e. a central exhaust fan serving multiple rooms).

Ducts serving supplemental exhaust fans, or a supplemental exhaust air intake that does not exceed 29' (9 m) in length and have no more than 4 elbows can be sized using Table 9.32.3.5.

Supplemental Exhaust Duct Size Table 9.32.3.5		
Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125mm)	5" (125mm)
51 - 100	6" (150mm)	6" (150mm)

Notes:

1) The duct shall always be at least as large as recommended by the manufacturer.
2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Where these tables are not suitable (e.g. airflow or length are beyond the parameters of the chart), or when the designer chooses too, then ducts shall be sized in accordance with "good engineering practice" in Part 6 such as:

- the HRAI duct sizing guide included in the HRAI Residential Ventilation using CSA F326 Manual,
- the HRAI Residential Air System Design Manual,
- ASHRAE Handbooks.

NOTE: The manual switch requirement can be satisfied by an On/Off switch on a dehumidistat or other automatic control.

Supplemental exhaust fans shall be controlled by a switch located in the room the fan serves.

If a supplemental exhaust fan serves more than one area, it shall be controlled by a switch in each of the locations it serves and the switches are to be wired in parallel so any switch can operate the fan.

NOTE: HRV/ERVs use a Hi/Low switch or timers in supplemental rooms and a dehumidistat in centrally located rooms marked, "VENTILATION FAN."

Newer options might include a device that controls the heating, cooling, humidification, dehumidification, and ventaltion needs of the dwelling all from one central control device.

If a principal exhaust fan provides the supplemental exhaust for any of the areas described above, it shall be controlled by a switch in each of the locations it serves in addition to the central switch referenced in section 9.32.3.4, and the switches are to be wired in parallel so any switch can operate the fan.

If an automatic control such as a dehumidistat is used to control a supplemental exhaust fan, there shall be a manual switch that can activate the supplemental exhaust fan regardless of the automatic control.

Supplemental exhaust required in this article may be provided by means of a heat recovery ventilator (HRV) or enthalpy recovery ventilator (ERV) installed in accordance with Section 9.32.3.11.

9.32.3.6 Ventilation Systems Coupled with Forced Air Heating Systems

NOTE: Interlocking the furnace to the HRV/ERV is not required under the OBC, but it is considered good practice.

Some programs such as ENERGY STAR or LEED for homes may have more specific requirements.

NOTE: The circulation fan switch can be provided by the fan on-auto switch on the forced air system thermostat.

If the ventilation system is coupled with the forced air system, (i.e. it relies on the forced-air system to distribute the supply air), then the following requirements apply:

- **Type I** houses do not require a ventilation fresh air supply inlet.
- **Type II** houses (solid fuel appliances) require an HRV/ERV, and it must be coupled to the forced air heating system.
- If the ventilation system is coupled to a forced-air heating system, then a manual switch is required adjacent to the ventilation fan switch to control the furnace blower. This switch shall be marked with the words "CIRCULATION FAN."

NOTE: Type I houses are permitted to have exhaust only ventilation systems that rely on fresh air being drawn in through the building envelope. It is then picked up by the return side of the forced air system and distributed throughout the house.

9.32.3.7 Ventilation Systems Not Coupled with Forced Air Heating Systems

If the ventilation system is not coupled with the forced air system, (e.g. there is no forced air system installed, or the ventilation system does not rely on the forced air system for distribution), then the ventilation system shall comply with the following:

- include an HRV, and
- circulate air throughout the house or dwelling unit by delivering fresh air too;
  - every bedroom,
  - any storey without a bedroom (including basement or heated crawlspace), and
  - if there is no storey without a bedroom, then the principal living area.

NOTE: Supply outlets for ventilation air, should be in the ceiling or in a wall within 12" (300 mm) of the ceiling and installed to promote mixing across the ceiling to prevent comfort complaints.

Outdoor Air Supply ducts, and Main Trunk ducts that do not exceed 69' (21 m) from the outdoor hood to any supply register or grille and having no more than 8 fittings can be sized using Table 9.32.3.7.A.

NOTE: While using Table 9.32.3.7.A, assume that a hood and grille are already included, and are not part of the 8 fittings.

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

NOTE: Although it is not specifically written in the OBC, Table 9.32.3.7.A and Table 9.32.3.7.B should be used for exhaust duct sizing when:

- the exhaust is provided by a central fan servicing multiple rooms (i.e. an HRV/ERV or central exhaust fan),
- is not a principal exhaust fan, and
- is not coupled to a forced air system.

NOTE: If, an HRV/ERV is used as the principal exhaust fan and it is not coupled to a forced air system, the requirements of section 9.32.3.4 and Table 9.32.4.B shall be used for the exhaust side, and the requirements of section 9.32.3.7 and Table 9.32.3.7.A.and Table 9.32.3.7.B. shall be used for the supply side.

NOTE: While using Table 9.32.3.7.B, assume that a hood and grille are already included, and are not part of the 8 fittings.

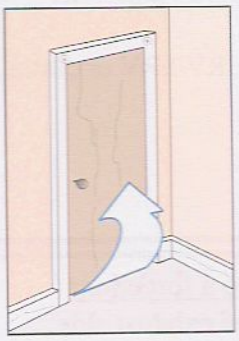
Branch ducts providing supply air to the rooms listed below that do not exceed 69' (21 m) from the outdoor hood to any supply register or grille and having no more than 8 fittings can be sized using Table 9.32.3.7.B.

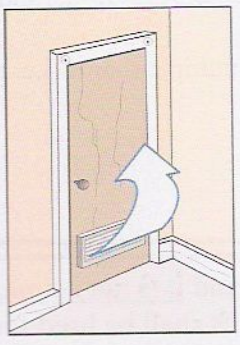
Minimum Branch Supply Duct Diameter Table 9.32.3.7.B		
Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Where these tables are not suitable (e.g. bedroom count or length are beyond the parameters of the chart), or when the designer chooses too, then ducts shall be sized in accordance with "good engineering practice" in Part 6 such as:

- the HRAI duct sizing guide included in the HRAI Residential Ventilation using CSA F326 Manual,
- the HRAI Residential Air System Design Manual,
- ASHRAE Handbooks.

All ventilation supply branch ducts whose diffusers do not have adjustable balance stops, shall be equipped with an adjustable damper that can be fixed in position and have a handle or other device to indicate the damper position.





If the ductwork is not accessible (e.g. above a finished ceiling), the damper can be installed behind the grille or diffuser. This will allow adjustment by removing the grille or diffuser.

Free flow of air to or from all rooms shall be provided by means of door undercuts or transfer grilles for ventilation systems that are not coupled to a forced-air system.

9.32.3.8 Protection Against Depressurization

NOTE: When considering protection against depressurization it would make sense to use the HRV/ERV as the principal exhaust fan, or maybe the entire ventilation system.

This section deals with the depressurization of a house created by exhaust fans and other exhaust devices.

Other than **Type III** houses (spillage susceptible) which must be designed under Part 6, there are only 2 requirements for Pressure Control;

- solid fuel-fired appliances and
- soil gases.

Solid Fuel Fired Appliances

The OBC states very explicitly that an HRV/ERV shall be provided when a solid fuel appliance is present. It does not specify what role it must play in the ventilation system, except it must be balanced so the exhaust flow cfm does not exceed the supply flow cfm in any operating mode.

NOTE: This requirement suggests an HRV/ERVs defrost strategy must be considered. If the strategy uses a method of shutting off the supply air and operating in an exhaust-only mode then the HRV/ERV cannot be used.

Soil Gases

NOTE: Good practice suggests a balanced ventilation system would be a good first step when soil gases are a concern but no specifics are given and the OBC does not require this.

When determining the need to provide protection against depressurization, consideration must be given to whether the presence of soil gases such as radon is deemed to be a problem.

The OBC is not explicit as to how to deal with the problem of soil gases except to say that a make-up air is not required for an exhaust device operating a subfloor depressurization system.

NOTE: Other parts of the OBC have requirements for radon mitigation, including subfloor depressurization systems, but this is outside the scope of a ventilation system design.

9.32.3.9 Fan Ratings

All required fans, except HRV/ERVs, shall be rated for airflow in accordance with:

- CAN/CSA-C260-M90 (R2007) "Rating the Performance of Residential Mechanical Ventilating Equipment," or
- HVI Publication 916, "Airflow Test Procedure."

HRV/ERV capacity is rated according to CAN/CSA-C439-18, "Rating the Performance of Heat/Energy-Recovery Ventilators."

NOTE: The OBC does not explicitly state that HRV/ERV capacity shall be rated according to CAN/CSA-C439-18. However, in Section 9.32.3.11 "Heat Recovery Ventilators", it does state that efficiency ratings must comply with CAN/CSA-C439-18 which suggest that CAN/CSA-C439-18 is the required rating program.

NOTE: HVI testing and certification is compatible with both CAN/CSA-C260-M90 (2007) and CSA-C439-18.

All required fans, except HRV/ERVs, shall be rated for sound in accordance with:

- CAN/CSA-C260-M90 (R2007), "Rating the Performance of Residential Mechanical Ventilating Equipment," or
- HVI Publication 915, "Loudness Testing and Rating Procedure."

NOTE: HRV/ERVs are excluded from the sound rating requirement because they fall under the scope of CAN/CSA-439-18, which has no reference to sound.

All required fan airflow shall be rated at the external static pressure (ESP) according to Table 9.32.3.9.A.

9.32.3.9.(3)

Capacity ratings for required fans shall be based on a static pressure differential of 50 Pa, 25 Pa, or 7.5 Pa depending on whether the fan is installed with ductwork connected on both sides, on side or neither side, respectively.

All required fans, except HRV/ERVs, used to make up any part of the total ventilation system, shall not exceed the noise ratings in Table 9.32.3.9.B.

Fan Sound Rating Table 9.32.3.9.B		
Fan Application	Maximum Sound Rating (sones)	
	According to CAN/CSA-C260-M	According to HVI 915
Principal Ventilation Exhaust Fan	2.0 sones	2.5 sones
Supplemental fans installed in bathrooms and their make-up air fans	2.5 sones	3.5 sones
Supplemental fans installed in kitchens and their make-up air fans	No rating required	No rating required

All ventilation equipment, including fans & HRV/ERVs, must be installed according to the manufacturer's instructions.

Mechanical ventilation devices shall conform to CSA C22.2 No. 113-M, "Fans and Ventilators." This standard applies to cord-connected and permanently connected fans and ventilators intended to be:

- connected to supply circuits of 600 V and less,
- used in non-hazardous locations,
- used indoors or outdoors, and
- used in accordance with the Rules of the Canadian Electrical Code, Part I.

9.32.3.10 Ducts

All ducts shall comply with Part 6 "Supply Ducts" with the exception of a duct serving only a bathroom or water closet room, which can be combustible, providing it is reasonably airtight and impervious to water.

Part 6 requires the following characteristics for ducting:

- be non-combustible,
- if supply ducts are in a building that is allowed to be of combustible construction and will not have air temperatures in excess of 248°F (120°C) they can be ULC S110 class 1 rated,
- use duct sealants with a flame spread rating, not more than 25 and a smoke development classification of not more than 50,
- use duct connectors (e.g. flex) that is ULC S110 class 1 rated,
- must be water and corrosion resistant, where they will be subjected to excessive moisture.

Duct sealants
(Source: http://www.durodyne.com/)

Flex duct

Exhaust duct shall not discharge into heated or unheated enclosed spaces such as:

- attics
- soffits
- garages
- crawl spaces
- porches
- sheds

Exhaust ducts that pass through unheated space, or that are not separated from an unheated space by an insulated building assembly shall be insulated to not less than R3 (RSI 0.5).

Supply ducts carrying outdoor air through a heated space (e.g. the outside air intake duct from the outside hood to an HRV/ERV) shall be insulated to a minimum of R3 (RSI 0.5) and have a vapour barrier.

If these ducts are more than 10' (3 m) in length, they must be insulated to a minimum level shown in Table 9.32.3.10.A.

NOTE: The OBC is not explicit regarding insulating supply ducts carrying tempered air (e.g. from an HRV/ERV to the occupied space). Good practice would be to insulate according to Table 9.32.3.10.A

Supply Duct Insulation for Ducts over 10' Long Table 9.32.3.10.A	
Outside Winter Design Temperature °F (°C)	**Minimum R-Value (RSI)**
19 to 12 (–7 to –11)	R3 (RSI 0.5)
10 to 1 (–12 to –17)	R5 (RSI 0.9)
0 to -11 (–18 to –24)	R7 (RSI 1.2)
-13 to -20 (–25 to –29)	R8 (RSI 1.4)
-22 to -29 (–30 to –34)	R10 (RSI 1.8)
-31 (–35) and colder	R12 (RSI 2.1)

Notes:

1) The outside winter design temperatures shall be those listed for the January 2.5 percent values.

A kitchen exhaust duct that does not have a filter in the grille shall be installed so that it is cleanable for its entire length.

Ducts connected to range hoods or range top fans shall:

- be of corrosion-resistant, non-combustible materials,
- exhaust directly to the outdoors,
- not connect to other fans or ducts,
- be equipped with a grease filter at the intake.

All ducts shall be permanently supported to prevent:

- sagging,
- excessive movement,
- vibration, and
- crushing.

All joints in ducts shall be sealed with liquid mastic, metal foil tape or manufacturer's specified sealant and constructed as to inhibit air leakage.

Duct sizing shall conform to OBC Table 9.32.3.4.B, Table 9.32.3.5, Table 9.32.3.7.A, and Table 9.32.3.7.B where applicable.

Where OBC duct sizing tables are not suitable (e.g. duct sizes are larger than what is listed), or when the designer chooses to, then ducts shall be sized in accordance with "good engineering practice" such as:

- the HRAI duct sizing guide included in the HRAI CSA F326 Residential Mechanical Ventilation Systems Manual,
- the HRAI Residential Air System Design Manual,
- ASHRAE Handbooks.

When a rectangular duct is used in place of a round duct, it shall be selected according to Table 9.32.3.10.B.

Rectangular Equivalent Duct Sizes Table 9.32.3.10.B (Imperial)

Required Round Duct Size (in.)	Permitted Equivalent Rectangular Duct Size, inches			
	Stack Duct	4-inch depth	5-inch depth	6-inch depth
3	3-1/4 x 10	2-1/4 x 4	-------	--------
4	3-1/4 x 10	3-1/2 x 4	3 x 5	3 x 6
5	3-1/4 x 10	5 x 4	4 x 5	3-1/4 x 6
6	3-1/4 x 12	8 x 4	6 x 5	5 x 6
7	3-1/4 x 14	11 x 4	8 x 5	7 x 6
>7	Design to Part 6			

Rectangular Equivalent Duct Sizes Table 9.32.3.10.B (Metric)

Required Round Duct Size (mm)	Permitted Equivalent Rectangular Duct Size, mm			
	Stack Duct	100 mm depth	125 mm depth	150 mm depth
75	82 x 250	57 x 100	-------	--------
100	82 x 250	89 x 100	75 x 125	75 x 150
125	82 x 250	125 x 100	100 x 125	89 x 150
150	82 x 300	200 x 100	150 x 125	125 x 150
175	82 x 350	275 x 100	200 x 125	175 x 150
>175	Design to Part 6			

Notes:

1) These equivalent sizes are for equal friction and capacity only – not for equal cross-sectional area or velocity.

NOTE: The OBC does not include oval duct equivalent sizes or tables. However, they have been included in this manual and are considered good practice.

Where oval duct is used in place of a round duct, it shall be selected according to HRAI's Oval Equivalent Duct Sizes Table.

Oval Equivalent Duct Sizes Table (Imperial) Note 1		
Round Duct Diameter (Inches)	Oval Equivalent duct sizes, inches	
	Manufacturer's Listed Diameter Note 2	Oval Size Note 3
3	4	3 x 4-9/16
4	5	3 x 6-1/8
5	6	3 x 7-3/4
6	8	3 x 10-7/8
7	Note 4	

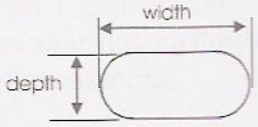
Oval Equivalent Duct Sizes Table (Metric) Note 1		
Round Duct Diameter (mm)	Oval Equivalent duct sizes, mm	
	Manufacturer's Listed Diameter Note 2	Oval Size Note 3
75	100	75 x 114
100	125	75 x 153
125	150	75 x 194
150	200	75 x 272
175	Note 4	

Notes:

1) These equivalent sizes are for equal friction and capacity only – not for equal cross-sectional area or velocity.

2) Some manufacturers refer to the size of an oval pipe based on the equivalent circumference of the corresponding round pipe, not its air handling ability. For example, 5" round pipe and 5" oval pipe will have the same measured circumference, not the same air handling ability.

3) Oval size data is based on commonly available manufacturer's sizes and is subject to change.



4) For sizes not listed the equivalent diameter given by the following formula must be at least as large as the Round Duct Diameter:

$$D_{equiv} = 1.55\ A^{.625} / P^{.25}$$

Where:
A is the cross-sectional area and
P is the perimeter (or circumference)

9.32.3.11 Heat Recovery Ventilators

Where an HRV/ERV is installed to provide all or part of the ventilation system, it shall comply with the following requirements.

HRV/ERVs must have minimum sensible heat recovery efficiency of 55% at -25°C at an airflow of not less than 60 cfm (30 L/s) according to CAN/CSA-C439.

NOTE: HRV/ERVs will also need to meet the efficiency requirements of SB-12.

When an HRV/ERV is coupled to a forced-air system, the supply duct must be directly connected to the return air side of the forced air system.

Two or more HRV/ERVs cannot be connected in parallel to a common supply duct unless specifically permitted by the manufacturer.

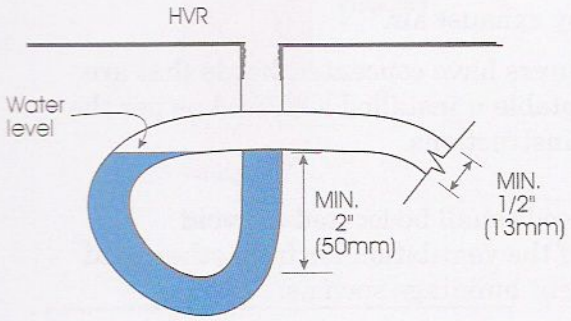
Two or more HRV/ERVs cannot be connected in parallel to a common downstream exhaust duct.

NOTE: Good practice would be to install these systems in a heated space to avoid any frost or ice that might form due to the extreme cold.

HRV/ERVs installed in unheated spaces shall be installed so as to avoid condensation on fans and motors in the exhaust air, in accordance with the manufacturer's instructions.

All manufacturer's start-up instructions, including airflow measurement and balancing, are to be followed. HRV/ERV balancing is covered in HRAI's HRV/ERV Installation & Balancing Fundamentals training course.

NOTE: Most manufacturers recommend balancing these systems on high speed (i.e. the TVC). It is reasonable to assume that if the HRV/ERV is balanced at high speed, it will be reasonably balanced on the lower speeds.



An HRV/ERV shall have a free-flowing condensate drain installed in accordance with the manufacturer's instructions. In the absence of manufacturer's instructions, the condensate drain shall:

- be a minimum of 1/2" (13 mm) nominal pipe size,
- be trapped,
- be pitched in the direction of flow,
- be installed and connected to the dwelling unit's drain system, and
- connected to a condensate pump of adequate capacity if required.

An HRV/ERV and all condensate lines shall be installed within a space where the temperature will not adversely affect the operation of the system.

When the HRV/ERV is operating at the required principal exhaust fan capacity, the lower of the exhaust and supply airflows shall be at least 90% of the higher flow unless otherwise recommended by the manufacturer.

NOTE: The balancing requirement is often worded as "the exhaust and supply airflows shall be within 10% of each other" which meets the intent of the code.

NOTE: Manufacturers require flow regulating dampers are installed in HRV/ERVs on both the main supply and main exhaust ducts. The dampers are generally located on the "warm" side of the HRV/ERV and should not be located in the insulated flex piping.

NOTE: Some HRV/ERVs come with a built-in flow adjusting dampers or other means of adjusting airflows such as, fan speed control and therefore external dampers may not be required.

9.32.3.12 Outdoor Intake and Exhaust Openings

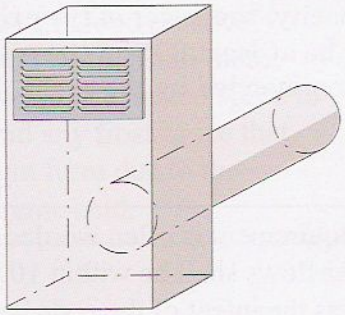
NOTE: There is no minimum hood separation. The OBC says **"avoid contamination by exhaust air."** "Good Practice", based on the sources of contamination sentence suggests 3 ft.

If an intake is located on the same wall or roof as the exhaust, then the intake must be placed to "avoid contamination by exhaust air."

Some manufacturers have concentric hoods that are considered acceptable if installed and used as per the manufacturers' instructions.

Supply intake hoods shall be located to avoid contamination of the ventilation air from other local sources or adjacent buildings such as:

- exhaust air openings,
- driveways (auto exhaust),
- combustion appliance vents,
- garbage containers,
- attics and crawl spaces, and
- under a deck or another area of questionable air quality.



Exterior wall riser

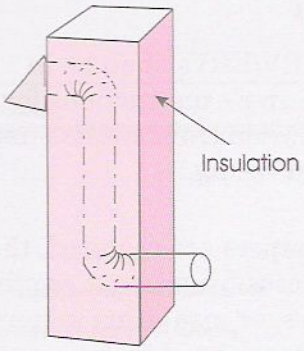
Supply intake hoods shall be located a minimum distance of 18" (450 mm) above grade or the depth of expected snow accumulation, whichever is greater. An exterior wall riser can be used to gain height.

NOTE: Check with the local gas authority regarding clearances from, gas meters, regulators, vents and other such items which may be greater than those required by the OBC.

Supply intake hoods shall be at least 3 ft (900 mm) from sources of contamination that penetrate the building envelope such as:

- combustion appliance vents,
- gas meters,
- oil tanks and pipes
- combustion appliance vents.

Supply intake hoods shall be labelled so the consumer can identify that the hood is drawing air into the house.



Exhaust riser

NOTE: A backdraft damper could be installed in the exhaust side of an HRV/ERV to prevent back drafting when the unit is not turned off.

Exhaust hoods shall be at least 4" (100 mm) above grade or other horizontal surfaces. An insulated pipe riser (snorkel) is acceptable, provided the pipe joints are sealed airtight and the riser is fully insulated.

All exterior hoods, intake and exhaust, shall be protected from precipitation by the use of louvres, weather cowls, or other suitable protection.

Outdoor intakes shall be protected from animal/insect entry with screens or grilles. For an HRV/ERV, insect protection is often provided by the filter in the HRV/ERV rather than with an insect screen at the hood.

Backdraft dampers are required on all exhaust outlets other than an exhaust outlet of an HRV/ERV.

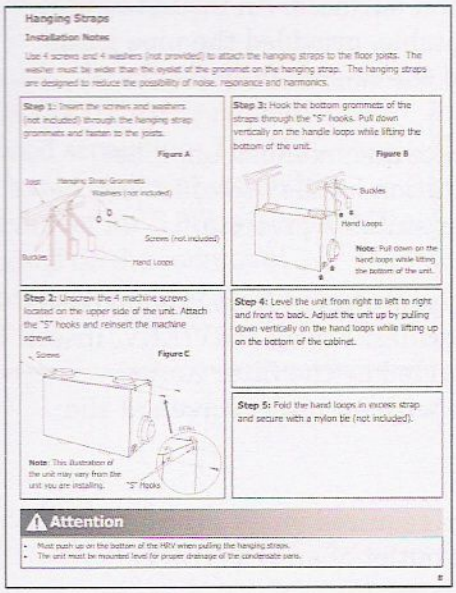
Except for clothes dryers, exhaust outlets shall be fitted with screens of mesh not larger than 1/2" (15 mm), except where climatic conditions may require larger openings.

A hood equipped with a screen made of mesh smaller than 1/4" (6 mm) (i.e. an insect screen) must meet the following:

- the screen must be removable for cleaning, and
- the screen must have a gross area three times the size of the duct served.

All screens and grilles shall be made of corrosion-resistant materials

Supply intakes and exhaust outlets shall have a free area of not less than the cross-sectional area of the duct served.



Manufacturer's installation instructions (Source: https://www.lifebreath.com/)

9.32.3.13 Installation

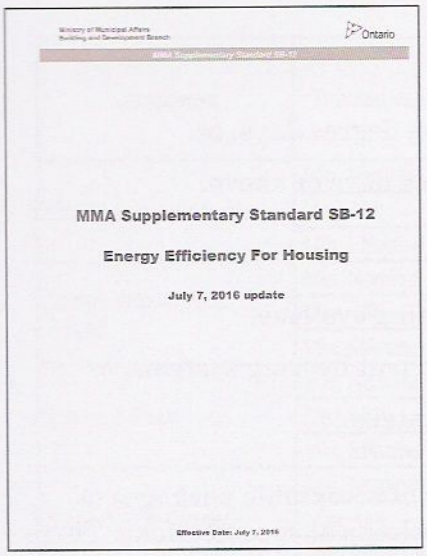
Installation of fans and HRV/ERVs shall be in accordance with manufacturer's instructions for minimizing noise and vibration transmission and achieve the required sound rating.

Where flow-regulating dampers are required, they shall be adjustable and accessible without requiring the removal of fans, motors, or insulating materials and without the need for specialized tools.

Ventilation equipment shall be accessible for inspection, maintenance, repair and cleaning.

Ventilation equipment installed in unheated spaces (e.g. bathroom fans) shall be installed so as to avoid condensation of moisture on fans and motors in accordance with the manufacturer's instructions.

SB-12 Energy Efficiency


Ministry of Municipal Affairs
Building and Development Branch

Ontario

MMA Supplementary Standard SB-12

Energy Efficiency For Housing

July 7, 2016 update

Effective Date: July 7, 2016

This section addresses the requirements to be considered when designing a ventilation system based on OBC Section 9.32.

SB-12 standard will require designers to consider energy efficiency when selecting the equipment and designing the distribution system.

Ventilation designers and installers need to be confident they have been provided with sufficient information from the person responsible for the energy efficiency requirements to complete their scope of work.

The following paragraphs provide highlights of the energy efficiency requirements.

12.2.1.2 Energy Design after Dec 31, 2016

There are 4 compliance options available for energy efficiency under Part 12 of the OBC.

1) 15% better than an EnerGuide Rating System (ERS) score of 80.
2) One of the prescriptive tables in Chapter 3 of the Supplementary Guideline SB-12.
3) Conformance with "Natural Resource Canada's ENERGY STAR for New Homes" (ESNH) or R2000 programs.
4) Performance compliance (energy simulation modelling demonstrating performance better than one of the prescriptive packages).

12.3.1.1 Energy Efficiency

The most common compliance path is the prescriptive options under which heat or energy recovery ventilators are mandatory. HRV/ERVs are also mandatory under the ESNH and R2000 programs. They are optional under the ERS and performance compliance paths.

The prescriptive tables are broken into two climate zones and three energy sources resulting in six sets of tables:

Climate Zone

- Below 5000 heating degree days, or
- 5000 heating degree days or above.

Energy Source

- 92% or higher heating systems,
- 84% up to 92% efficient heating systems, or
- Electric heating systems.

Each table has a number of acceptable packages of insulation values and mechanical specifications. There is a total of 30 packages.

NOTE: For the purpose of this code guide, HRAI has used soft conversion factor to come up with 60 cfm (= 30 L/s) but a designer may be required to use 64 cfm based on hard conversion under certain circumstances.

Each package specifies a minimum sensible recovery efficiency (SRE) for the HRV/ERV at 32°F (0°C) with a minimum flow equal to the principal ventilation capacity (see Section 9.32.3.4) but the flow rate does not need to exceed 60 cfm (30 L/s).

SB-12 reinforces compliance with OBC Section 9.32.3.11.

NOTE: These efficiency requirements are separate from the OBC 9.32 requirements described earlier. Both requirements must be met.

The minimum sensible heat recovery efficiencies for HRV/ERVs range from a low of 55% in one package to a high of 81%, depending on the prescriptive package selected.

Houses with tested airtightness below certain thresholds can use HRVs with reduced efficiency.

Additions to existing buildings have alternative compliance options that may or may not require an HRV/ERV.

Ventilation designers and installers are reminded to either develop a detailed knowledge of the energy efficiency requirements of SB-12 or to have their work verified by the person responsible for the energy efficiency compliance.

Table 3.1.1.2.A (IP)
ZONE 1 - Compliance Packages for Space Heating Equipment with AFUE ≥ 92%
Forming Part of Sentence 3.1.1.2.(1)

Component	Thermal Values[8]	Compliance Package					
		A1	A2	A3	A4	A5	A6
Ceiling with Attic Space	Min. Nominal R[1]	60	60	50	60	50	60
	Max. U[2]	0.017	0.017	0.020	0.017	0.020	0.017
	Min. Effective R[2]	59.22	59.22	49.23	59.22	49.23	59.22
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	31	35	31	35	31
	Max. U[3]	0.034	0.034	0.031	0.034	0.031	0.034
	Min. Effective R[3]	29.80	29.80	32.02	29.80	32.02	29.80
Walls Above Grade	Min. Nominal R[1]	22	19 + 5 ci	14 + 7.5 ci	22 + 5 ci	19 + 5 ci	22 + 5 ci
	Max. U[3]	0.059	0.049	0.054	0.047	0.049	0.047
	Min. Effective R[3]	17.03	20.32	18.62	21.40	20.32	21.40
Basement Walls[6]	Min. Nominal R[1]	20 ci	12 +10 ci	20 ci	20 ci	12 + 5 ci	20 ci
	Max. U[4]	0.047	0.048	0.047	0.047	0.063	0.047
	Min. Effective R[4]	21.12	20.84	21.12	21.12	15.96	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	—	—	—	—	—	—
	Max. U[4]	—	—	—	—	—	—
	Min. Effective R[4]	—	—	—	—	—	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
	Max. U[4]	0.090	0.090	0.090	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.28	0.28	0.25	0.28	0.28	0.28
	Energy Rating	25	25	29	25	25	25
Skylights	Max. U[5]	0.49	0.49	0.49	0.49	0.49	0.49
Space Heating Equipment	Min. AFUE	96%	96%	94%	96%	94%	92%
HRV	Min. SRE	75%	75%	81%	75%	70%	65%
Domestic Water Heater[7]	Min. EF	0.80	0.70	0.67	0.67	0.80	0.80
Column 1	2	3	4	5	6	7	8

Note: The above compliance package table was retrieved from Ontario's Ministry of Municipal Affairs' Supplementary Standard SB-12 for reference at the time of developing this manual. Individuals should always check Ontario's Ministry of Municipal Affairs and Housing's website (www.mah.gov.on.ca) for the latest edition of the Supplementary Standard SB-12 and the full list of compliance packages and options available.

Table 3.1.1.2.C (IP)
ZONE 1 - Compliance Packages for Electric Space Heating
Forming Part of Sentence 3.1.1.2.(3)

Component	Thermal Values[8]	Compliance Package			
		C1	C2	C3	C4
Ceiling with Attic Space	Min. Nominal R[1]	60 + HH	60 + HH	50	50
	Max. U[2]	0.016	0.016	0.020	0.020
	Min. Effective R[2]	59.90	59.90	49.23	49.23
Ceiling Without Attic Space	Min. Nominal R[1]	31	31	31	31
	Max. U[2]	0.036	0.036	0.036	0.036
	Min. Effective R[2]	27.65	27.65	27.65	27.65
Exposed Floor	Min. Nominal R[1]	31	31	35	35
	Max. U[3]	0.034	0.034	0.031	0.031
	Min. Effective R[3]	29.80	29.80	32.02	32.02
Walls Above Grade	Min. Nominal R[1]	19 + 10 ci	22 + 10 ci	22 + 10 ci	22 + 7.5 ci
	Max. U[3]	0.040	0.038	0.038	0.042
	Min. Effective R[3]	25.32	26.40	26.40	23.90
Basement Walls[6]	Min. Nominal R[1]	20 + 8 ci	20 ci	20 ci	20 ci
	Max. U[4]	0.044	0.047	0.047	0.047
	Min. Effective R[4]	22.71	21.12	21.12	21.12
Below Grade Slab Entire Surface > 600 mm Below Grade	Min. Nominal R[1]	7.5	—	—	—
	Max. U[4]	0.116	—	—	—
	Min. Effective R[4]	8.63	—	—	—
Heated Slab or Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10
	Max. U[4]	0.090	0.090	0.090	0.090
	Min. Effective R[4]	11.13	11.13	11.13	11.13
Edge of Below Grade Slab ≤ 600 mm Below Grade	Min. Nominal R[1]	10	10	10	10
Windows and Sliding Glass Doors	Max. U[5]	0.25	0.21	0.21	0.28
	Energy Rating	29	34	34	25
Skylights	Max. U[5]	0.49	0.49	0.49	0.49
Space Heating Equipment	Min.	—	—	—	ASHP: 7.1 HSPF
HRV	Min. SRE	81%	75%	81%	55%
Domestic Water Heater[7]	Min. EF	—	—	—	—
Column 1	2	3	4	5	6

Note: The above compliance package table was retrieved from Ontario's Ministry of Municipal Affairs' Supplementary Standard SB-12 for reference at the time of developing this manual. Individuals should always check Ontario's Ministry of Municipal Affairs and Housing's website (www.mah.gov.on.ca) for the latest edition of the Supplementary Standard SB-12 and the full list of compliance packages and options available.

OBC 9.32 DESIGN PROCEDURE

This section of the manual describes the procedures and calculations used to design and record the ventilation system for a house/dwelling according to Section 9.32 of the Ontario Building Code (OBC).

The procedure uses a series of worksheets describing different aspects of a ventilation system considered essential to the design and installation of a ventilation system meeting Section 9.32 of the OBC.

These worksheets are designed to be used as submittal forms when completed. However, it is important to note these worksheets are based on an HRAI interpretation of the requirements and users should always check with the "Authority Having Jurisdiction."

Note: For these worksheets, all airflows are entered in CFM*. To convert L/s to cfm, multiply by a soft conversion of 1 L/s = 2 cfm.

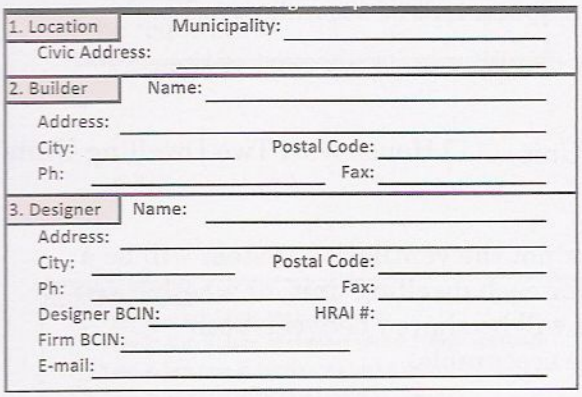
Table of Contents

Residential Mechanical Ventilation Design Summary

HRAI has developed the following worksheet and procedure as a guide for recording critical information relevant to the design requirements of a ventilation system complying with Section 9.32 of OBC 2012. A copy of the worksheet can be found on p45.

Sections of the worksheet that are not applicable should be marked as N/A.

This worksheet has been divided into specific sections focusing on the main requirements described in the Ontario Building Code (OBC).


1. Location Municipality: _____
Civic Address: _____
2. Builder Name: _____
Address: _____
City: _____ Postal Code: _____
Ph: _____ Fax: _____
3. Designer Name: _____
Address: _____
City: _____ Postal Code: _____
Ph: _____ Fax: _____
Designer BCIN: _____ HRAI #: _____
Firm BCIN: _____
E-mail: _____

1. Location

Identify the house/dwelling location and record:

- Municipality:
- Civic address:

2. Builder

Identify the builder or the company taking responsibility for the entire project and record:

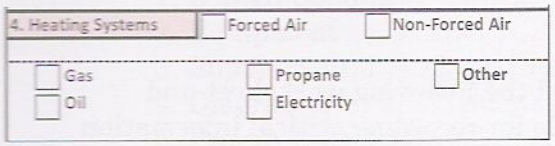
- Name:
- Address:
- City/Postal Code:
- Telephone/Fax number:

3. Designer

Identify the company or designer taking responsibility for the design of the ventilation system and a record of any required certifications.

- Name:
- Address:
- City Postal Code:
- Telephone/Fax number:
- Designer and/or Firm BCIN #:
- HRAI certification #:
- E-mail address:

4. Heating System



Check (√) the appropriate boxes:

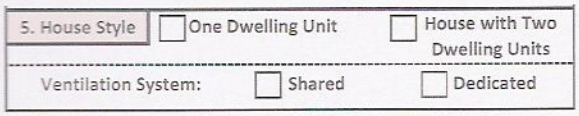
Identify the heating system strategy and the appliance fuel types being used in the dwelling unit.

☐ Forced Air ☐ Non-Forced Air

☐ Gas ☐ Propane ☐ Other

☐ Oil ☐ Electricity

5. House Style



Check (√) the appropriate boxes:

The OBC now allows for a second dwelling unit within a house, such as an apartment or secondary suite.

Identify how many dwelling units are part of the house.

☐ One Dwelling Unit ☐ House with Two Dwelling Units

Identify whether or not the ventilation system will be a dedicated system for each dwelling unit, or whether the ventilation system will be shared between both dwellings (both are acceptable).

☐ Shared ☐ Dedicated

6. Combustion Appliances

6. Combustion Appliances

- ☐ a) Direct Vent
- ☐ b) Induced Draft
- ☐ c) Natural Draft
- ☐ d) Solid Fuel Appliances
- ☐ e) No Combustion Appliances

Check (√) the appropriate boxes:

Identify the types of venting systems manufacturers use to remove the byproducts of combustion. This information is used to determine the house type.

☐ a) Direct Vent. ☐ b) Induced Draft.

☐ c) Natural Draft ☐ d) Solid Fuel Appliances

☐ e) No Combustion Appliances

Note: The OBC does not allow spillage susceptible systems, except for solid fuel fired appliances, to be installed under 9.32.

For spillage susceptible systems other than solid fuel fire appliances, a Part 6 design will be required.

Combustion venting strategies fall into 2 categories:

- Spillage.
- Non-spillage.

Definitions of the different venting types can be found in the introductory online module "Basic Principles of Residential Ventilation" manual.

7. Type of House

7. Type of House

- ☐ Type 1: a) or b) type appliances only
- ☐ Type 2: a) or b) type appliances with a d) type appliance
- ☐ Type 3: any type c) appliance = part 6 design
- ☐ Type 4: electric space heat (same as Type 1)

Check (√) the appropriate box:

Identify which of the 4 house types described in Section 9.32.3.1 applies.

☐ Type 1: a) or b) type appliances only.

☐ Type 2: a) or b) type appliances with a d) type appliance.

☐ Type 3: any type c) appliance = part 6 design.

☐ Type 4: electric space heat.

8. System Design Option

8. System Design Option

- ☐ Exhaust only forced air system (coupled to forced air)
- ☐ HRV/ERV with extended exhaust or simplified (coupled to forced air)
- ☐ HRV/ERV full ducting (not coupled to forced air)

Check (√) the appropriate box:

Identify the type of distribution system being used for the ventilation air.

☐ Exhaust only forced air system (coupled to forced air).

☐ HRV/ERV with extended exhaust or simplified (coupled to forced air).

☐ HRV/ERV full ducting (not coupled to forced air).

9. Total Ventilation Capacity (TVC)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	2	@ 20 CFM (10 L/s)	40	CFM
Other Bedrooms	1	@ 10 CFM (5 L/s)	10	CFM
Bathrooms & Kitchen	2	@ 10 CFM (5 L/s)	20	CFM
Other Habitable Rooms	2	@ 10 CFM (5 L/s)	20	CFM
Total Ventilation Capacity (TVC)			90	CFM

Calculate the total ventilation capacity (TVC), sometimes referred to as the minimum amount of ventilation air that must be delivered to the house when at maximum occupant or contaminant load.

Total Ventilation Capacity Table 9.32.3.3

Room	Capacity	
	cfm	L/s
Master bedrooms[1]	20	10
Other bedrooms	10	5
Living Room[2]	10	5
Dining Room[2]	10	5
Kitchen	10	5
Family Room[2]	10	5
Recreation Room	10	5
Basement area[3]	20	10
Other habitable rooms[4]	10	5
Bathroom or Water Closet	10	5
Laundry room	10	5
Utility Room	10	5

- Record the number of rooms requiring 20 cfm of ventilation air and calculate a total.
- Record the number of rooms requiring 10 cfm of ventilation air based on their type and calculate a total.
- When all the rooms in the house or dwelling have an assigned cfm, calculate the Total Ventilation Capacity.

For more detail, refer to the total ventilation capacity Table 9.32.3.3, found in Worksheets, Tables & Charts section of this manual.

10. TVC System

10. TVC System

☐ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

Check (√) the appropriate boxes:

Identify the type of fans being used to supply the TVC (more than one could be possible).

☐ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

11. Principal Ventilation Capacity (PVC)

11. Principal Ventilation Capacity (PVC)				
Master Bedroom	1	@ 30 CFM (15 L/s)	30	CFM
Other Bedrooms	1	@ 15 CFM (7.5 L/s)	15	CFM
Total Principal Ventilation Capacity (PVC)			45	CFM

Calculate the principal ventilation capacity (PVC), sometimes referred to as the standard operating cfm of the ventilation system. This calculation is based on the principal exhaust fan capacity Table 9.32.3.4.A and is calculated using CFM (L/s) per bedroom.

Principal Exhaust Fan Capacity Table 9.32.3.4.A

Number of Bedrooms	Capacity	
	cfm	L/s
1	30	15
2	45	22.5
3	60	30
4	75	37.5
5	90	45
More than 5	Part 6 Design	

- Record the number of bedrooms in the dwelling unit, according to Table 9.32.3.4.A.
    - As a general rule, if a room could be used as a bedroom, it must be included in the bedroom count. For houses with more than 5 bedrooms, the design option must be done according to CSA-F326.
- When all of the bedrooms in the house or dwelling have an assigned cfm, calculate the principal ventilation capacity (PVC).

For more detail, refer to the "Principal Exhaust Fan Capacity Table 9.32.3.4.A, found in Worksheets, Tables & Charts section of this manual.

12. Principal Ventilation Fan

Identify the principal ventilation fan information and record:

- Location installed:
- Fan Manufacturer:
- Fan Model #:

Check (√) the appropriate box identifying:

☐ Is the fan HVI rated:

- All types of fans shall be HVI rated according to Section 9.32.3.9.

- Rated Airflow:

The rated airflow is based on the PVC information found from Table 9.32.3.4.A and recorded in section 11 of this worksheet. The rated airflow cfm must not be lower than what is recorded in section 11.

The rated airflow should be recorded at the external static pressure (ESP). minimum (from table 9.32.3.9.A) for the type of fan being used and can be found in the manufacturers' specification sheets.

12. Principal Ventilation Fan

Location: _____
Manufacturer: _____
Model: _____ ☐ HVI Rated
Rated Airflow: Low: _____ CFM High: _____ CFM
Sones: _____ ESP: _____ " w.c.

_____ % Sensible Efficiency @ 0 C° _____ CFM
_____ % Sensible Efficiency @ -25 C° _____ CFM
(If HRV/ERV was used, the system must also comply with SB-12)

External Static Pressure Table 9.32.3.9.A

Fan configuration (application)	Minimum External Static Pressure	
	Inches Water Column	Pascals
Through the wall fans	.03" w.c.	7.5 Pa
Fans with ducts on one side only (e.g. a bathroom fan)	.1" w.c.	25 Pa
Fans with ducts on both sides (e.g. a central exhaust fan or HRV)	.2" w.c.	50 Pa

When the principal exhaust fan (PEF) is a single speed fan, it is acceptable for the PEF cfm to exceed the PVC minumum by up to 50%. This allowance actually creates a range the PEF can operate in.

- If a single speed fan is used, the cfm should be entered into the "Low" section and must be between 100% and 150% of the PVC recorded in section 11 of this worksheet.

When the PEF has multiple speeds, such as an HRV/ERV, then the PEF can operate at either the total ventilation capacity (TVC) and/or the principal ventilation capacity (PVC).

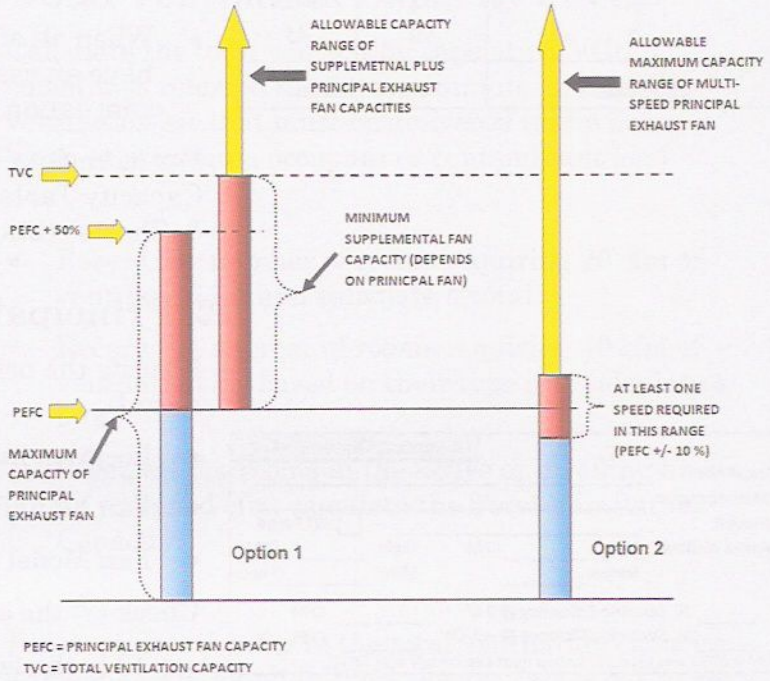


Figure 1: Principal Ventilation Exhaust Fan(s) Compliance Options

Total Ventilation Capacity

- When the PEF is used to meet the TVC (or higher) and has a cfm greater than the 50% allowance mentioned above for the PVC, then it must have a low-speed setting capable of operating between 90% and 110% of the PVC.

  In this case, high speed can be used in place of supplemental fans to achieve the TVC, and low speed will be used to achieve the PVC.

- When using this strategy, the PVC range should be entered into the "Low" section, and the TVC requirement should be entered into the "High" section. It is important to note that there is no upper limit when recording this value.

Principal Ventilation Capacity

- When an HRV/ERV is used to meet the PVC only, then enter the PEF cfm into the "Low" section when using low speed to meet the PVC minimum, or enter the PEF cfm into the "High" section when using high speed to meet the PVC minimum (both options would be considered acceptable).

Fan Sound Rating Table 9.32.3.9.B		
Fan Application	Maximum Sound Rating (sones)	
	According to HVI 915	According to CAN/CSA-C260-M
Principal Ventilation Exhaust Fan	2.5 sones	2.0 sones
Supplemental fans installed in bathrooms and their make-up air fans	3.5 sones	2.5 sones
Supplemental fans installed in kitchens and their make-up air fans	No rating required	No rating required

External Static Pressure Table 9.32.3.9.A		
Fan configuration (application)	Minimum External Static Pressure	
	Inches Water Column	Pascals
Through the wall fans	.03" w.c.	7.5 Pa
Fans with ducts on one side only (e.g. a bathroom fan)	.1" w.c.	25 Pa
Fans with ducts on both sides (e.g. a central exhaust fan or HRV)	.2" w.c.	50 Pa

- Sone rating (if applicable):
  - Sone ratings are required for principal fans according to Table 9.32.3.9.B.
  - HRV/ERVs are exempt from this requirement and have no maximum rating.
- ESP rating:
  - The external static pressure (ESP) is based on the rated airflow and must be at least the minimum requirement from Table 9.32.3.9.A.
- Efficiency rating (if applicable)

The last 2 lines of section 12 will only be completed if the fan is an HRV/ERV. These lines are used for building code efficiency requirements where applicable.

When using an HRV/ERV, Section 9.32 of the OBC has precise requirements when it comes to the selection of this type of equipment.

- HRV/ERVs must have a minimum sensible recovery efficiency (SRE) of 55% at -13 °F (-25°C) at an airflow of not less than 60 cfm (30 L/s) according to section 9.32.3.11.
- Each SB-12 package specifies a minimum sensible recovery efficiency (SRE) for the HRV/ERV at 32°F (0°C) at a minimum flow not less than the PVC but need not exceed 60 cfm (30 L/s).

The performance data for the principal ventilation fan required in this section can be found in the HVI catalogue or from the manufacturer's specifications.

13. Supplemental Exhaust Fan Capacity (SEF)

13. Supplemental Exhaust Fan Capacity (SEF)		
Required Total Ventilation Capacity	______	CFM
Less Rated Principal Ventilation Capacity	______	CFM
Required Supplemental Ventilation Capacity	______	CFM

Calculate the supplemental exhaust fan capacity required to make up the difference between the required TVC cfm and the installed PVC cfm.

- Record the required total ventilation capacity:
  - o This information can be found in section 9 of this worksheet.
- Record the rated principal ventilation capacity:
  - o This information can be found in section 12 of this worksheet (rated airflow).
- Required supplemental ventilation capacity:
  - o Subtract the rated PVC from the required TVC and record the required supplemental ventilation capacity minimum that must be exhausted from the house.
  - o If an HRV/ERV is used to achieve the TVC and the PVC, then no supplemental cfm will be required. This design strategy may result in the required supplemental ventilation capacity being zero or a negative number.

14. Additional Equipment

14. Additional Equipment	
Location: ______	Sones: ______
Manufacturer: ______	☐ HVI Rated
Model: ______	☐ TVC
Rated Airflow: ______ CFM	ESP: ______ " w.c.
Location: ______	Sones: ______
Manufacturer: ______	☐ HVI Rated
Model: ______	☐ TVC
Rated Airflow: ______ CFM	ESP: ______ " w.c.
Location: ______	Sones: ______
Manufacturer: ______	☐ HVI Rated
Model: ______	☐ TVC
Rated Airflow: ______ CFM	ESP: ______ " w.c.
Location: ______	Sones: ______
Manufacturer: ______	☐ HVI Rated
Model: ______	☐ TVC
Rated Airflow: ______ CFM	ESP: ______ " w.c.

Additional space has been provided for other exhaust devices located in the dwelling unit that are not recorded in section 12. There is a room for up to four additional fans, such as bathroom fans and range hood fans.

Identify the Supplemental Fans and record:

- Location installed:
- Fan Manufacturer:
- Fan Model #:

Fan Sound Rating Table 9.32.3.9.B		
Fan Application	Maximum Sound Rating (sones)	
	According to HVI 915	According to CAN/CSA-C260-M
Principal Ventilation Exhaust Fan	2.5 sones	2.0 sones
Supplemental fans installed in bathrooms and their make-up air fans	3.5 sones	2.5 sones
Supplemental fans installed in kitchens and their make-up air fans	No rating required	No rating required

- Sone rating (if applicable):
  - Sone ratings are required for supplemental fans according to Table 9.32.3.9.B.
  - HRV/ERVs are exempt from this requirement and have no rating maximum.

Check (√) the appropriate box identifying:

☐ Is the fan HVI rated:

- All types of fan shall be HVI rated according to Section 9.32.3.9.

Check (√) the appropriate box identifying:

☐ Is the fan part of the TVC system?

- In some applications, more than one fan will be used to meet the TVC requirement. When this occurs, the box shall be marked.

External Static Pressure Table 9.32.3.9.A		
Fan configuration (application)	Minimum External Static Pressure	
	Inches Water Column	Pascals
Through the wall fans	.03" w.c.	7.5 Pa
Fans with ducts on one side only (e.g. a bathroom fan)	.1" w.c.	25 Pa
Fans with ducts on both sides (e.g. a central exhaust fan or HRV)	.2" w.c.	50 Pa

- Rated Airflow:
  - The rated airflow is based on the type of fan and where the fan is being used. The rated airflow should be recorded at the external static pressure (ESP) minimum (from Table 9.32.3.9.A) for the type of fan being used and can be found in the manufacturer's specifications sheets.

    There are no specific requirements around supplemental exhaust cfm; however, it is considered "Good Practice" to use the values referenced in the National Building Code (100 cfm in a kitchen, 50 cfm in a bathroom).

- ESP rating:
  - The ESP is based on the rated airflow and must be at least the minimum requirement from Table 9.32.3.9.A.

The performance data for the additional equipment required in this section can be found in the HVI catalogue or from the manufacturer's specifications.

15. Design Consent

15. Designer Consent

I _____certify this ventilation system is designed to be in accordance with OBC-2012 9.32

Date: _____ Signature: _____

Identify the person taking responsibility for the design and record:

- The designer taking responsibility for the design
- The date completed
- Sign as taking responsibility

RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location
Municipality: ______
Civic Address: ______

2. Builder
Name: ______
Address: ______
City: ______ Postal Code: ______
Ph: ______ Fax: ______

3. Designer
Name: ______
Address: ______
City: ______ Postal Code: ______
Ph: ______ Fax: ______
Designer BCIN: ______ HRAI #: ______
Firm BCIN: ______
E-mail: ______

4. Heating Systems ☐ Forced Air ☐ Non-Forced Air

☐ Gas ☐ Propane ☐ Other
☐ Oil ☐ Electricity

5. House Style ☐ One Dwelling Unit ☐ House with Two Dwelling Units

Ventilation System: ☐ Shared ☐ Dedicated

6. Combustion Appliances
☐ a) Direct Vent ☐ b) Induced Draft
☐ c) Natural Draft ☐ d) Solid Fuel Appliances
☐ e) No Combustion Appliances

7. Type of House
☐ Type 1: a) or b) type appliances only
☐ Type 2: a) or b) type appliances with a d) type appliance
☐ Type 3: any type c) appliance = part 6 design
☐ Type 4: electric space heat (same as Type 1)

8. System Design Option
☐ Exhaust only forced air system (coupled to forced air)
☐ HRV/ERV with extended exhaust or simplified (coupled to forced air)
☐ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	______	@ 20 CFM (10 L/s)	______	CFM
Other Bedrooms	______	@ 10 CFM (5 L/s)	______	CFM
Bathrooms & Kitchen	______	@ 10 CFM (5 L/s)	______	CFM
Other Habitable Rooms	______	@ 10 CFM (5 L/s)	______	CFM
		Total Ventilation Capacity (TVC)	______	CFM

10. TVC System
☐ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	______	@ 30 CFM (15 L/s)	______	CFM
Other Bedrooms	______	@ 15 CFM (7.5 L/s)	______	CFM
		Total Principal Ventilation Capacity (PVC)	______	CFM

12. Principal Ventilation Fan
Location: ______
Manufacturer: ______
Model: ______ ☐ HVI Rated
Rated Airflow: Low: ______ CFM High: ______ CFM
Sones: ______ ESP: ______ " w.c.
______ % Sensible Efficiency @ 0 C° ______ CFM
______ % Sensible Efficiency @ -25 C° ______ CFM
(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)
Required Total Ventilation Capacity ______ CFM
Less Rated Principal Ventilation Capacity ______ CFM
Required Supplemental Ventilation Capacity ______ CFM

14. Additional Equipment

Location: ______ Sones: ______
Manufacturer: ______ ☐ HVI Rated
Model: ______ ☐ TVC
Rated Airflow: ______ CFM ESP: ______ " w.c.

Location: ______ Sones: ______
Manufacturer: ______ ☐ HVI Rated
Model: ______ ☐ TVC
Rated Airflow: ______ CFM ESP: ______ " w.c.

Location: ______ Sones: ______
Manufacturer: ______ ☐ HVI Rated
Model: ______ ☐ TVC
Rated Airflow: ______ CFM ESP: ______ " w.c.

Location: ______ Sones: ______
Manufacturer: ______ ☐ HVI Rated
Model: ______ ☐ TVC
Rated Airflow: ______ CFM ESP: ______ " w.c.

15. Designer Consent
I ______________________ certify this ventilation system is designed to be in accordance with OBC-2012 9.32
Date: ______ Signature: ______

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

HRAI

 Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

OBC DUCT SIZING – PRINCIPAL FAN DUCT

HRAI has developed the following worksheet and procedures as a guide for recording critical information relevant to the duct sizing requirements of a Principal Fan, complying with Section 9.32 of OBC 2012. A copy of the worksheet can be found at the end of this section.

This worksheet has the capacity to record information on ducting for a principal ventilation fan that is part of the dwelling ventilation system. Sections of the worksheet that are not applicable should be marked as N/A.

This worksheet has been divided into specific sections focusing on the main requirements described in the Ontario Building Code (OBC).

1. Design Condition

1. Design Condition

Location: _____

# of Bedrooms: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

Identify the principal ventilation fan information and record:

- Location installed:
- # of Bedrooms:
  - Record the number of bedrooms in the house/dwelling.
- Design Airflow:
  - The design airflow is based on the principal ventilation capacity (PVC) information recorded on the Residential Mechanical Ventilation Design Summary section 11.
  - If the fan is used to meet the total ventilation capacity (TVC) and principal ventilation capacity (PVC), then the design airflow will be based on the TVC information recorded on the Residential Mechanical Ventilation Design Summary section 9.
- ESP rating:
  - The External Static Pressure (ESP) is based on the design airflow and must be equal to/or greater than the minimum requirement from Table 9.32.3.9.A.

External Static Pressure Table 9.32.3.9.A

Fan configuration (application)	Minimum External Static Pressure	
	Inches Water Column	Pascals
Through the wall fans	.03" w.c.	7.5 Pa
Fans with ducts on one side only (e.g. a bathroom fan)	.1" w.c.	25 Pa
Fans with ducts on both sides (e.g. a central exhaust fan or HRV)	.2" w.c.	50 Pa

- It is acceptable to select the rated cfm at an ESP greater than what is required from Table 9.32.10.A. as long as the design cfm has been achieved.

2. Equipment

2. Equipment	☐ Coupled to Forced Air	☐ Not Coupled
☐ HRV/ERV	☐ Exhaust Fan	☐ Inline Fan
Make:		
Model:		
Equipment Rated Airflow: _____ cfm @ _____ " w.c.		

Check (√) the appropriate box identifying the type of distribution system being used:

☐ Coupled to Forced Air ☐ Not Coupled.

Check (√) the appropriate box identifying the type of fan being used:

☐ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

From the Residential Mechanical Ventilation Design Summary section 12, identify the principal ventilation fan information and record:

- Fan Make:
- Fan Model #:
- Equipment Rated Airflow: cfm and ESP "w.c.:
  - The equipment rated airflow and inches w.c. must have a cfm equal to, or greater than, the design airflow at the design ESP in inches w.c. This is used to verify the equipment is capable of delivering the required design cfm at the correct ESP.

The performance data for the principal ventilation fan required in this section can be found in the HVI catalogue or from the manufacturer's specifications.

3. Exhaust Duct Sizing

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Correctly size the duct diameter capable of delivering the intended design airflow, according to Table 9.32.3.4.B.

Table 9.32.3.4.B can be used for:

- The exhaust side of a principal fan (coupled to a forced-air heating/cooling system).
- The exhaust side of a principal fan (multiple branch duct system not coupled to a forced-air heating/cooling system).

- The supply side of a principal fan (coupled to a forced-air heating/cooling system).

Table 9.32.3.4.B can be found at the bottom of the OBC Principal Duct Sizing worksheet as well as in Worksheets, Tables & Chart section of this manual.

Identify the Duct Sizing information and record:

- Longest Total Duct Length from Grille to Outdoor Hood:
    - This is the longest measured total length of duct connected to the fan. The total duct length can not exceed 39' measured from a grille to the outdoor hood for any single branch.
    - When an HRV/ERV is used, and it is coupled to a forced-air heating/cooling system, then the longest total length shall be based on either the supply or exhaust duct system (whichever is greater).
- # of elbows used:
    - This is the number of elbows (90° elbow) installed from a grille to the outdoor hood for any single branch. The total number of elbows can not exceed 4.
    - When an HRV/ERV is used as the principal ventilation fan, and it is coupled to a forced-air heating/cooling system, then the number of elbows shall be based on either the supply or exhaust duct system (whichever is greater).
- Min. Required Diameter for Exhaust Duct
    - Record the round duct diameter for both trunk and/or branch ducts using Table 9.32.3.4.B for smooth or flex ducting.

When using Table 9.32.3.4.B:

- Select the number of bedrooms recorded in section 1 of this worksheet.
- Select one of two options:
    - ducts connected to two sides of a fan, or
    - ducts connected to one side of a fan.

- The correct smooth, round duct size will be where this information intersects and the following rules apply:
  1) The duct shall always be at least as large as recommended by the manufacturer.
  2) If flexible ducting is used, it shall be increased by 1" (25 mm).
  3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm).
  4) Where the principal exhaust fan (PEF) is connected to the return air system of the forced air heating system, the duct shall be increased by 1" (25mm).

- Min. Required Diameter for Supply Duct from Outdoor Hood to Return (if Applicable)
  - When the principal ventilation fan is capable of delivering fresh air to the house/dwelling such as an HRV/ERV, and it is coupled to the return air ducting of a heating/cooling system, then the same rules apply to the supply side of the system and should be sized according to Table 9.32.3.4.B.
  - However, when the supply side fan is not coupled to the return air ducting of a heating/cooling system, then supply duct sizing Table 9.32.3.7.A shall be used as described on page 50.

4. Supply Duct Sizing – For Systems Not Coupled With Forced Air

NOTE: A trunk duct is a duct that has more than one branch connected to it. A branch is a duct that supplies to or exhausts from only one point.

Correctly size the supply trunk and branch duct diameter capable of delivering the intended design airflow, according to Tables 9.32.3.7.A & 9.32.3.7.B.

Tables 9.32.3.7.A and 9.32.3.7.B can be used for the supply side of a principal ventilation fan, or any other type of supply fan that is not coupled to a forced-air heating/cooling system.

Tables 9.32.3.7.A and 9.32.3.7.B can be found at the bottom of the OBC Principal Duct Sizing worksheet as well as in Worksheets, Tables & Chart section of this manual.

- Longest Total Duct Length from Grille to Outdoor Hood:
  - This is the longest measured total length of duct connected to the fan. The total duct length can not exceed 69' measured from a grille to the outdoor hood for any single branch.
- Total # of fittings used:
  - This is the number of fittings installed from a grille to the outdoor hood.
  - The total number of fittings (e.g. elbows, tee's, etc.) cannot exceed 8 from the grille to the outdoor hood for any single branch. The grille and hood are not included in the number of fittings calculations.
- Min. Required Diameter for Outdoor Supply & Trunk Duct
  - Select the number of bedrooms recorded in section 1 of this worksheet and use the corresponding value for the correct duct size.
  - Record the round duct diameter using Table 9.32.3.7.A for smooth or flex ducting.

    There are no specific requirements around flexible ductwork when using this Table; however, it is considered "Good Practice" to increase flexible ducting by 1" (25 mm).

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B		
Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

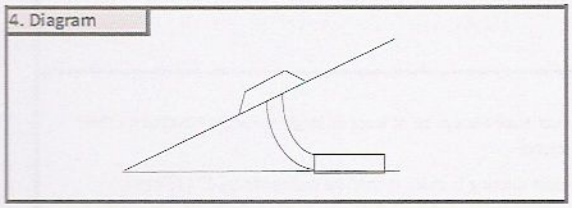
- Min. Required Diameter for Supply Branch Duct:
  - Select the type of room that will receive fresh air such as:
    - Master Bedroom
    - Other Bedroom
    - Story with no bedroom or living area
  - Select one of two options:
    - 1 and 2 Bedroom Dwelling Units,

      or
    - 3,4 and 5 Bedroom Dwelling Units.
  - The correct smooth, round duct size will be where this information intersects with one another:
  - Record the round duct diameter using Table 9.32.3.7.B for smooth or flex ducting.

    There are no specific requirements around flexible ductwork when using this Table; however, it is considered "Good Practice" to increase flexible ducting by 1" (25 mm).

5. Diagram

4. Diagram



Sketch a drawing that conveys the intent of the design. This sketch should be similar to what is actually installed.

6. Project Information

Record who has done the actual design within the design firm and include information such as:

- Prepared by:
- HRAI #:
- Location or project number:
- Signature:
- Date:
- Official use:

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: _____

# of Bedrooms: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment ☐ Coupled to Forced Air ☐ Not Coupled

☐ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: _____ (39' max)

# of elbows used: _____ (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	_____	_____	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:	_____	_____			(see Table 9.32.3.4.B)

4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

Longest Total Duct Length from Grille to Outdoor Hood: _____ (69' max)

Total # of fittings used: _____ (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		_____	_____	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	_____	_____	(see Table 9.32.3.7.B)
	2) Other Bedrooms	_____	_____	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	_____	_____	(see Table 9.32.3.7.B)

5. Diagram

OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

HRAI

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

OBC DUCT SIZING – SUPPLEMENTAL FAN DUCT

HRAI has developed the following worksheet and procedures as a guide for recording critical information relevant to the duct sizing requirements of a supplemental fan, complying with Section 9.32 of OBC 2012. A copy of the worksheet can be found on p56.

This worksheet has the capacity to record information on two single duct fans that are part of the dwelling ventilation system. Sections of the worksheet that are not applicable should be marked as N/A.

This worksheet has been divided into specific sections focusing on the main requirements described in the Ontario Building Code (OBC).

1. Design Condition

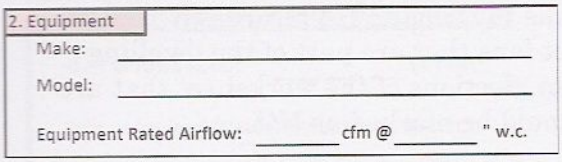
1. Design Condition
Location: _____
Design Airflow: _____ cfm ESP: _____ " w.c.
Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

Identify the supplemental fan information and record:

- Location installed:
- Design Airflow:
  - The design airflow is based on the type of fan and where the fan is being used.
  - This information is recorded on the Residential Mechanical Ventilation Design Summary section 13. (Supplemental Exhaust Fan Capacity). In some circumstances the design airflow will be selected by the designer.
    - For example a ventilation system may use multiple supplemental fans in order to meet the TVC requirement. When this occurs the design airflow of these supplemental fans when combined must equal the total recorded on the Residential Mechanical Ventilation Design Summary section 13. (Supplemental Exhaust Fan Capacity).
  - There are no specific requirements around supplemental exhaust cfm; however, it is considered "Good Practice" to use the values referenced in the National Building Code (100 cfm in a kitchen, 50 cfm in a bathroom).

- ESP rating:
    - The External Static Pressure (ESP) is based on the design airflow and must be equal to the minimum requirement from Table 9.32.3.9.A.

2. Equipment

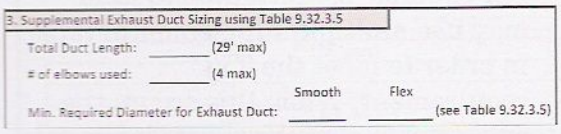

2. Equipment
Make: _____
Model: _____
Equipment Rated Airflow: _____ cfm @ _____ " w.c.

Identify the Ventilation Fan information and record:

- Fan Make:
- Fan Model #:
- Equipment Rated Airflow cfm and ESP "w.c.:
    - The equipment rated airflow and inches w.c. must have a cfm equal to, or greater than, the design airflow at the design ESP in inches w.c. This is used to verify that the equipment is capable of delivering the required design cfm at the correct ESP
    - It is acceptable to select the rated cfm at an ESP greater then what is required from Table 9.32.10.A. so long as the design cfm has been achieved.

The performance data for the supplemental fan required in this section can be found in the HVI catalogue or from the manufacturer's specifications.

3. Supplemental Exhaust Duct Sizing

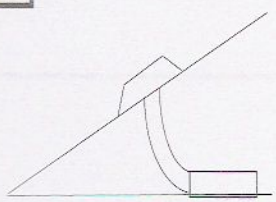

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5
Total Duct Length: _____ (29' max)
# of elbows used: _____ (4 max)
Smooth Flex
Min. Required Diameter for Exhaust Duct: _____ _____ (see Table 9.32.3.5)

- Total Duct Length:
    - This is the longest measured total length of duct connected to the fan. The total duct length can not exceed 29' measured from a grille to the outdoor hood.
- # of elbows used:
    - This is the number of elbows (90° elbow) installed from the grille to the outdoor hood.
    - The total number of elbows can not exceed 4 from the grille to the outdoor.

Supplemental Exhaust Duct Size Table 9.32.3.5		
Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

- Min. Required Diameter for Exhaust Duct
  - Select the cfm recorded in section 2 of this worksheet and find the allowable range in Table 9.32.3.5.
  - When the cfm is beyond the limits specified in Table 9.32.3.5 a different duct sizing option should be used, such as HRAI's duct sizing method described in the Residential Ventilation using CSA F326 manual and training.
  - Select one of two options:
    - ducts connected to two sides of a fan, or
    - ducts connected to one side of a fan.
  - The correct smooth, round duct size will be where this information intersects with one another and the following rules apply:
    1) The duct shall always be at least as large as recommended by the manufacturer.
    2) If flexible ducting is used, it shall be increased by 1" (25 mm).
  - Record the round duct diameter for smooth and flexible ducting.

4. Diagram



4. Diagram

Sketch a drawing that conveys the intent of the design. This sketch should be similar to what is actually installed.

5. Project Information

Record who has done the actual design within the design firm and include information such as:

- Prepared by:
- HRAI #:
- Location or project number:
- Signature:
- Date:
- Official Use

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: _____ (29' max)

# of elbows used: _____ (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	(see Table 9.32.3.5)

4. Diagram

1. Design Condition

Location: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: _____ (29' max)

# of elbows used: _____ (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	(see Table 9.32.3.5)

4. Diagram

OBC Table 9.32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

EXERCISES

This section of the manual is comprised of four exercise floor plans and drawings. They are used primarily to illustrate system layout and duct design.

Table of Contents

Exercise 1: Exhaust Only System (London)

Front View

Back View

Building Site

568 Hamilton Rd.

London, Ontario, N5V 1A1

Builder

JH House Designs

101 Willow Ave.

Ilderton, Ontario, N0M 8H6

Phone: 519-695-5325

Fax: 519-695-5324

Designing Firm

HRAI

2350 Matheson Blvd. East, Suite 101

Mississauga, Ontario, L4W 5G9

Phone: 905-602-4700

Fax: 905-602-1197

Web Address: www.HRAI.ca

Heating System:

The heating system shall be a natural gas forced air furnace with air conditioning. The heating system layout has been provided on the floor plans on p61.

House Style:

The house is a newly built, single-detached home with a dedicated ventilation system. The floor plans are provided on p61.

SB-12 Compliance:

The SB-12 compliance requirement for the house will be met using performance compliance based on the simulated annual energy use of the building. Therefore, no HRV is required.

Combustion Appliances:

The house will contain the following combustion appliances:

- Direct vent 92% natural gas furnace
- Direct vent natural gas water heater

Ventilation System:

The ventilation system is to be an exhaust-only system coupled to a forced air heating system.

An appropriately sized bath fan shall meet the principal ventilation capacity. The total ventilation capacity will be accomplished using the principal ventilation fan (PVF) and the range hood.

Duct System

The bathroom fan duct and the range hood duct shall be sized according to the drawings on the following pages.

Exhaust Devices:

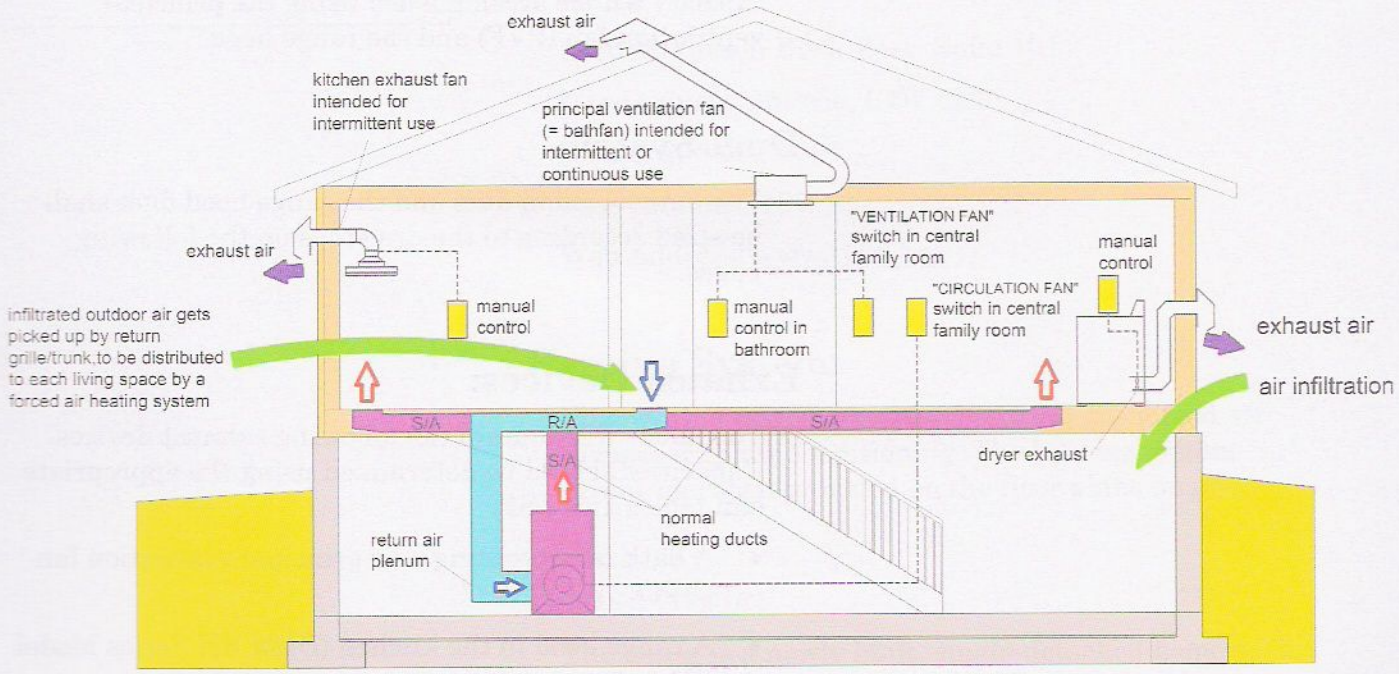
The house will contain the following exhaust devices. Capacities should be determined using the appropriate cfm tables and ESP:

- A bath fan operating as a principal ventilation fan (PVF)
- A range hood in the kitchen (DLM RH Series Model RH 146)
- An electric clothes dryer on the main floor

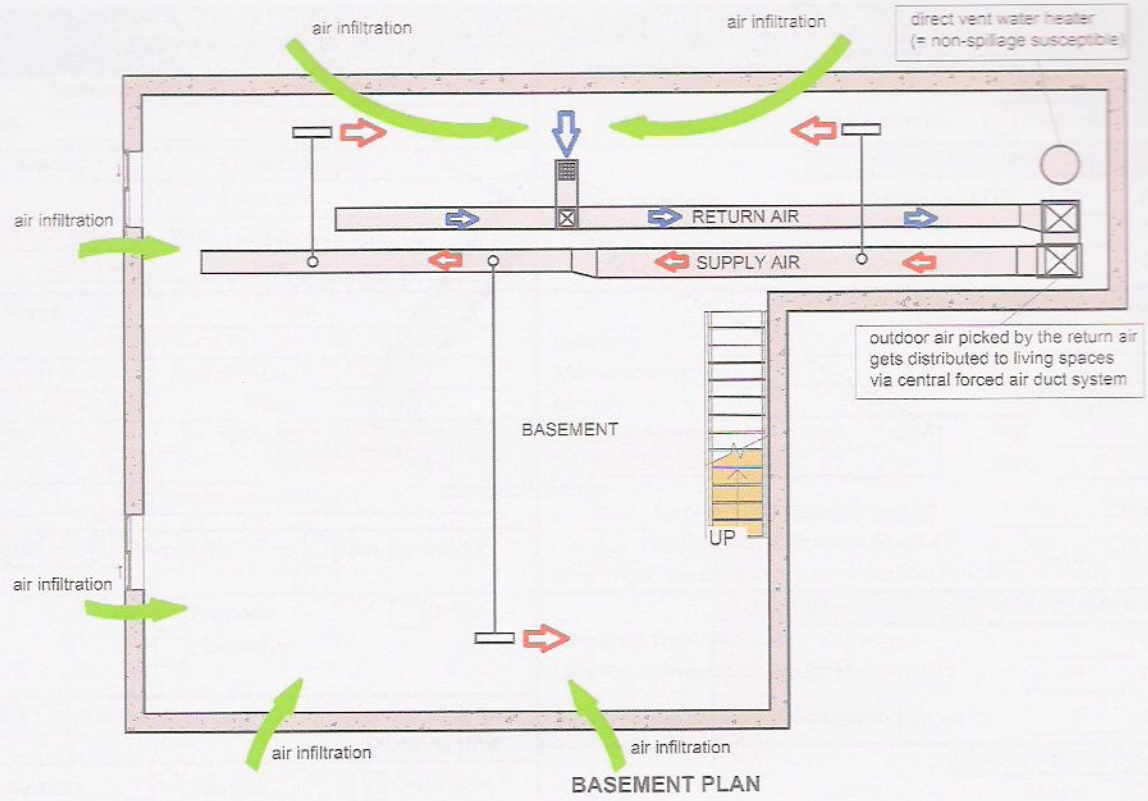
Control Devices:

The house will contain the following control devices:

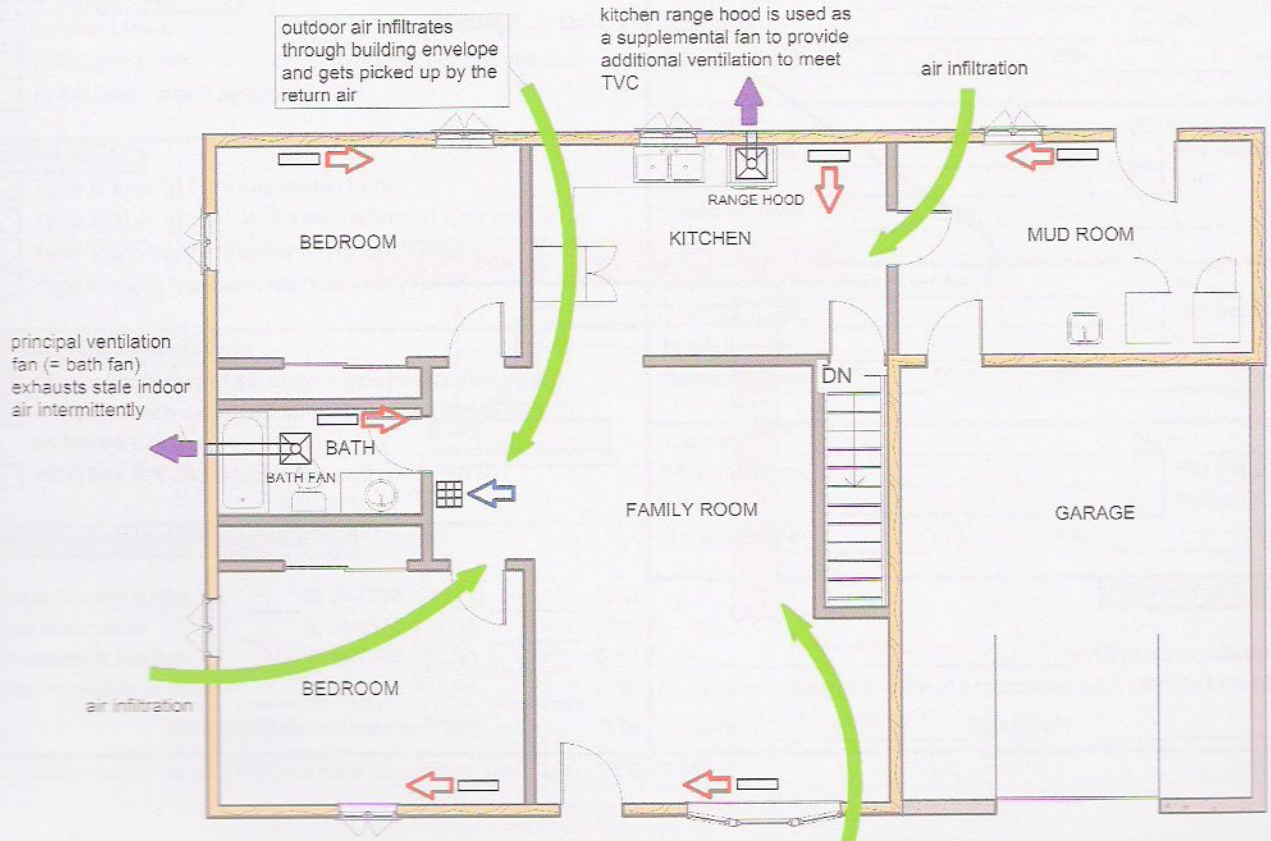
- The bath fan, serving as a principal ventilation fan, shall have a manual switch located in the central living area of the house labelled VENTILATION FAN, located right next to the manual switch controlling the furnace blower labelled CIRCULATION FAN.
- The bath fan will also be controlled by a local On/Off switch located in the bathroom in addition to the above-mentioned VENTILATION FAN switch. The switches are to be wired in parallel so that any switch can operate the fan.
- The range will be controlled by a local On/Off switch located on the device.



VENTILATION SYSTEM OVERVIEW

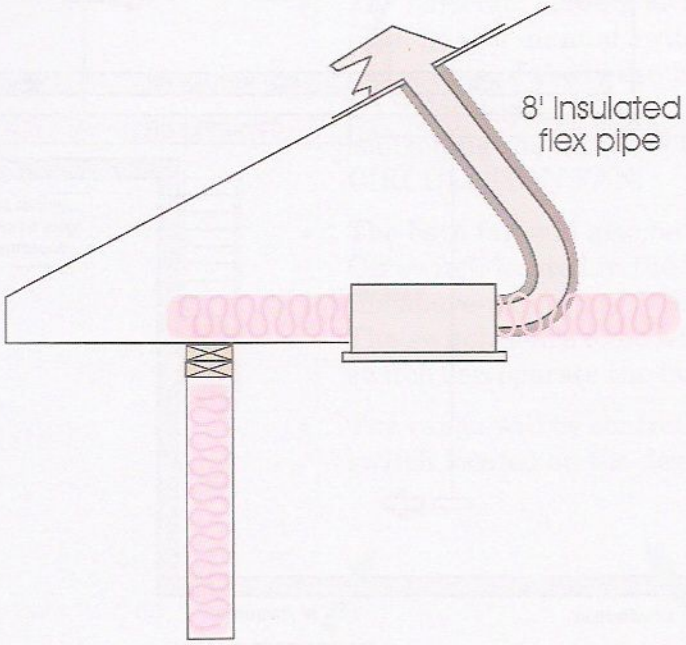


BASEMENT PLAN

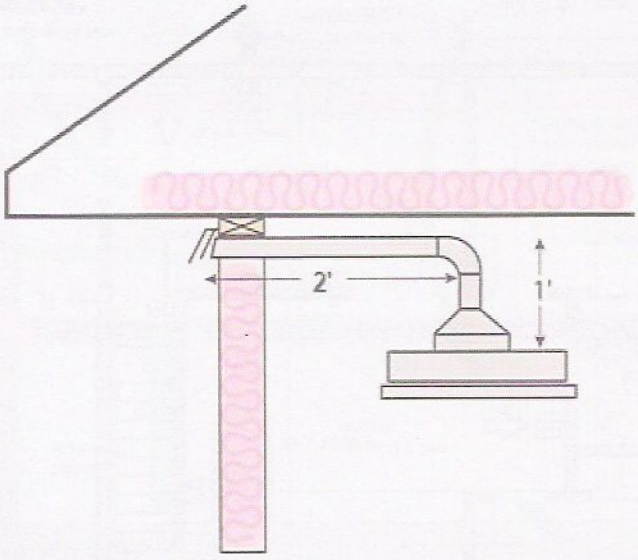


MAIN FLOOR PLAN

Bath Fan Layout:



Range Hood Layout



RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location
Municipality: London Exercise 1
Civic Address: 568 Hamilton Rd.

2. Builder
Name: JH House Designes
Address: 101 Willow Ave.
City: Ilderton, Ontario Postal Code: N0M 8H6
Ph: 519-695-5325 Fax: 519-695-5324

3. Designer
Name: HRAI
Address: 2350 Matheson Blvd. East, Suite 101
City: Mississauga, Ontario Postal Code: L4W 5G9
Ph: 905-602-4700 Fax: 905-602-1197
Designer BCIN: ##### HRAI #: ####
Firm BCIN: #####
E-mail: Web Address: www.HRAI.ca

4. Heating Systems
☑ Forced Air ☐ Non-Forced Air

☑ Gas ☐ Propane ☐ Other
☐ Oil ☐ Electricity

5. House Style
☑ One Dwelling Unit ☐ House with Two Dwelling Units

Ventilation System: ☐ Shared ☑ Dedicated

6. Combustion Appliances
☑ a) Direct Vent ☐ b) Induced Draft
☐ c) Natural Draft ☐ d) Solid Fuel Appliances
☐ e) No Combustion Appliances

7. Type of House
☑ Type 1: a) or b) type appliances only
☐ Type 2: a) or b) type appliances with a d) type appliance
☐ Type 3: any type c) appliance = part 6 design
☐ Type 4: electric space heat (same as Type 1)

8. System Design Option
☑ Exhaust only forced air system (coupled to forced air)
☐ HRV/ERV with extended exhaust or simplified (coupled to forced air)
☐ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	2	@ 20 CFM (10 L/s)	40	CFM
Other Bedrooms	1	@ 10 CFM (5 L/s)	10	CFM
Bathrooms & Kitchen	2	@ 10 CFM (5 L/s)	20	CFM
Other Habitable Rooms	2	@ 10 CFM (5 L/s)	20	CFM
Total Ventilation Capacity (TVC)			90	CFM

10. TVC System
☐ HRV/ERV ☐ Central Exhaust ☑ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	1	@ 30 CFM (15 L/s)	30	CFM
Other Bedrooms	1	@ 15 CFM (7.5 L/s)	15	CFM
Total Principal Ventilation Capacity (PVC)			45	CFM

12. Principal Ventilation Fan
Location: Bathroom
Manufacturer: DLM Bath Fan
Model: EF50 ☑ HVI Rated
Rated Airflow: Low: 50 CFM High: N/A CFM
Sones: 0.5 ESP: 0.1 " w.c.

N/A % Sensible Efficiency @ 0 C° N/A CFM
N/A % Sensible Efficiency @ -25 C° N/A CFM
(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)

Required Total Ventilation Capacity	90	CFM
Less Rated Principal Ventilation Capacity	50	CFM
Required Supplemental Ventilation Capacity	40	CFM

14. Additional Equipment
Location: Kitchen Sones: 8.5
Manufacturer: DLM Range Hood ☑ HVI Rated
Model: RH 146 ☑ TVC
Rated Airflow: 146 CFM ESP: 0.1 " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

15. Designer Consent
I HRAI Certificate Holder certify this ventilation system is designed to be in accordance with OBC-2012 9.32
Date: August 20, 2019 Signature:

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

HRAI

 Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Bathroom

# of Bedrooms: 2

Design Airflow: 45 cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

☑ Coupled to Forced Air ☐ Not Coupled

☐ HRV/ERV ☑ Exhaust Fan ☐ Inline Fan

Make: DLM Bath Fan

Model: EF50

Equipment Rated Airflow: 50 cfm @ 0.1 " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: 8' (39' max)

# of elbows used: 1 (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	N/A	N/A	5"	6"	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:			N/A	N/A	(see Table 9.32.3.4.B)

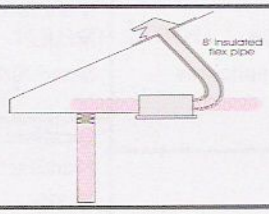
4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

Longest Total Duct Length from Grille to Outdoor Hood: N/A (69' max)

Total # of fittings used: N/A (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		N/A	N/A	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	N/A	N/A	(see Table 9.32.3.7.B)
	2) Other Bedrooms	N/A	N/A	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	N/A	N/A	(see Table 9.32.3.7.B)

5. Diagram



OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By:	HRAI Certificate Holder	HRAI #:	####	Location:	London, Ontario
Signature:		Date:	August 20, 2019	Official Use:	Exercise 1

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Kitchen

Design Airflow: 40 cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: DLM Range Hoods

Model: RH 146

Equipment Rated Airflow: 100 cfm @ 0.2 " w.c.

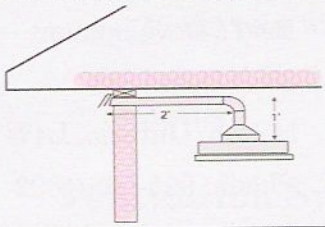
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 3' (29' max)

# of elbows used: 1 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	(see Table 9.32.3.5)

4. Diagram



1. Design Condition

Location: N/A

Design Airflow: N/A cfm ESP: N/A " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: N/A

Model: N/A

Equipment Rated Airflow: N/A cfm @ N/A " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: N/A (29' max)

# of elbows used: N/A (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	N/A	N/A	(see Table 9.32.3.5)

4. Diagram

OBC Table 9.32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By: HRAI Certificate Holder	HRAI #: ####	Location:	London, Ontario
Signature:	Date: August 20, 2019	Official Use:	Exercise 1

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

Exercise 2: HRV Simplified with Bathroom Exhaust (Mississauga)

Front View

Back View

Building Site

1634 Belton Way

Mississauga, Ontario, L4W 4K8

Builder

Reid's Development

5586 David St.

Milton, Ontario, L4W 6Y5

Phone: 905-568-4892

Fax: 905-568-4891

Designing Firm

HRAI

2350 Matheson Blvd. East, Suite 101

Mississauga, Ontario, L4W 5G9

Phone: 905-602-4700

Fax: 905-602-1197

Web Address: www.HRAI.ca

Heating System:

The heating system shall be a natural gas forced air furnace with air conditioning. The heating system layout has been provided on the floor plans on p69.

House Style:

The house is a newly built, single-detached home with a dedicated ventilation system. The floor plans are provided on p69.

SB-12 Package

The house SB-12 package will be based around Zone 1 (<5000-degree days), "Compliance Packages for Space Heating Equipment with AFUE ≥ 92%."

- Compliance package A6
- HRV/ERV 65% Sensible Recovery Efficiency

Combustion Appliances:

The house will contain the following combustion appliances:

- Direct vent 92% natural gas furnace
- Induced draft (power vent) natural gas water heater

Ventilation System:

The ventilation system is to be a simplified HRV coupled to a forced air heating system.

An appropriately sized HRV shall achieve the principal ventilation capacity. The total ventilation capacity will be met using the PVF and 1 other supplemental fan (designers' choice).

This is currently a very common HRV system design.

Duct System:

The HRV duct system shall be designed and sized according to the drawings on the following pages. The bathrooms' fan ducts and the range hood duct shall be sized according to the drawings on the following pages.

Exhaust Devices:

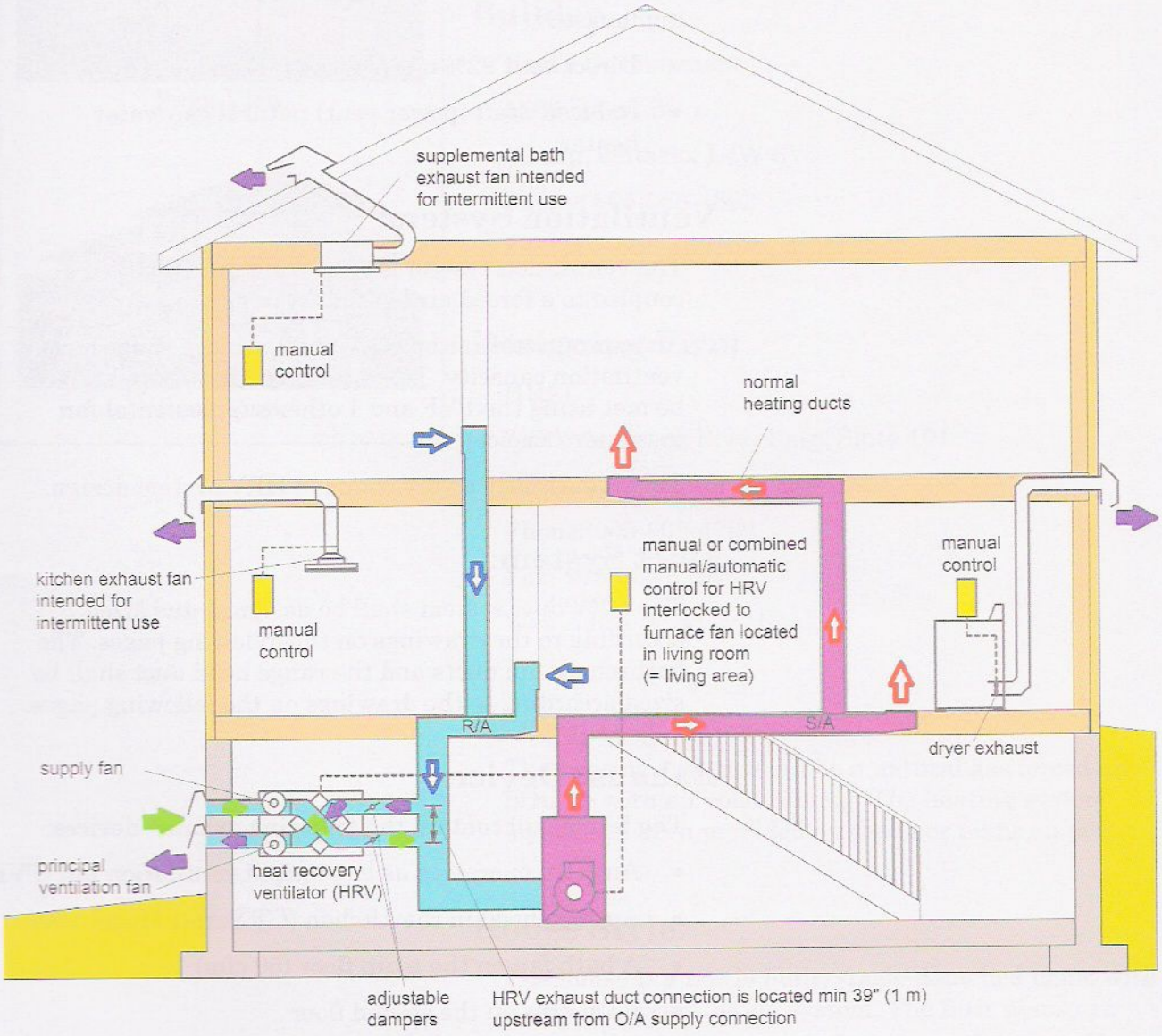
The house will contain the following exhaust devices:

- An HRV operating as a principal ventilation fan (PVF)
- A range hood in the kitchen (CT Series Model 180)
- A bath fan on the main floor (50 cfm)
- Bath fans on the second floor
- An electric clothes dryer on the main floor

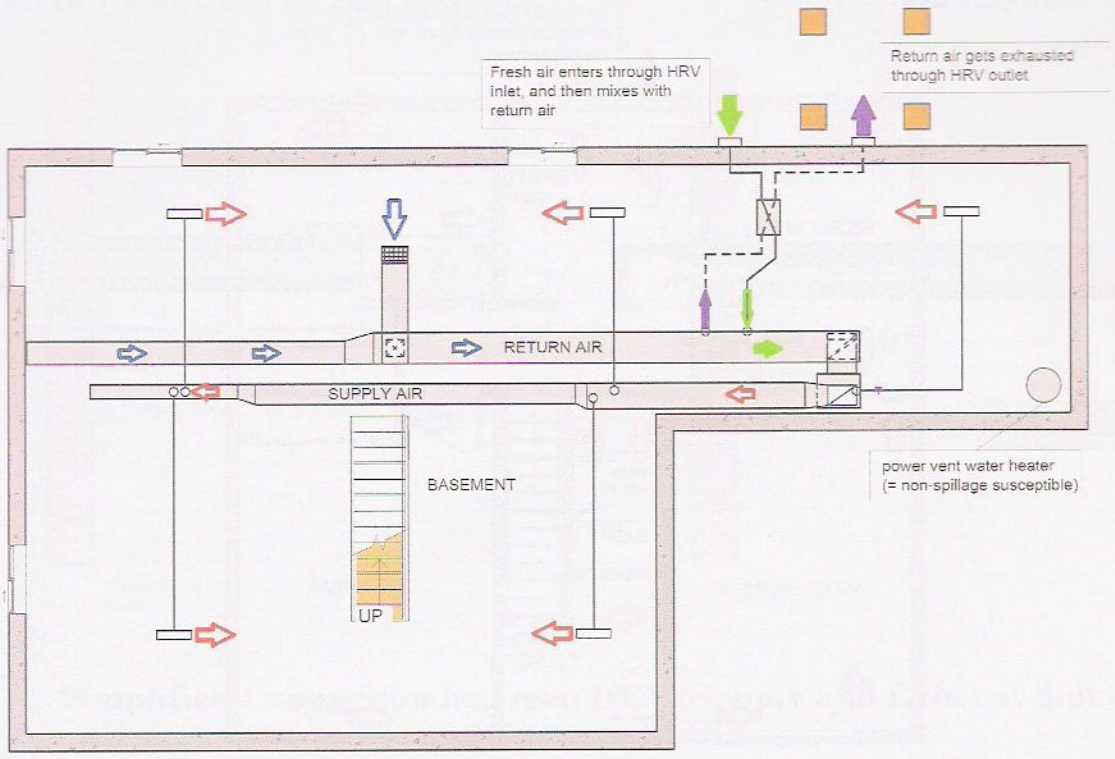
Control Devices:

The house will contain the following control devices:

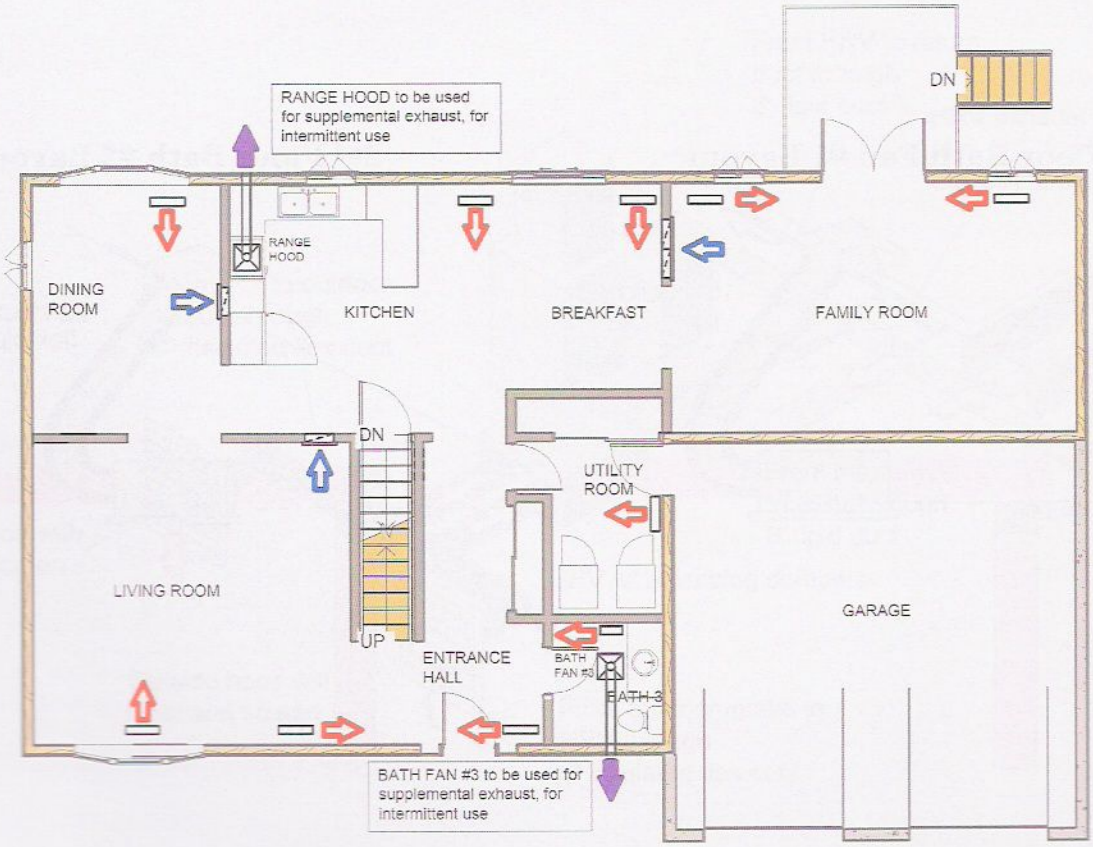
- A central principal ventilation fan (PVF) control interlocked to the furnace and the HRV (e.g. dehumidistat located in the living room) labelled VENTILATION FAN
- A local On/ Off switch located in each bathroom
- The range will be controlled by a local On/Off switch located on the device



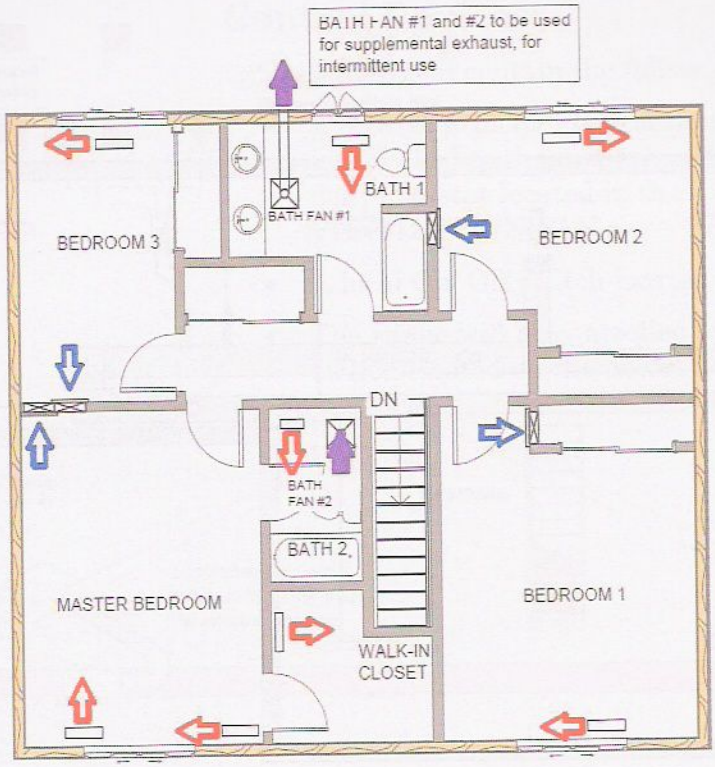
VENTILATION SYSTEM OVERVIEW



BASEMENT PLAN

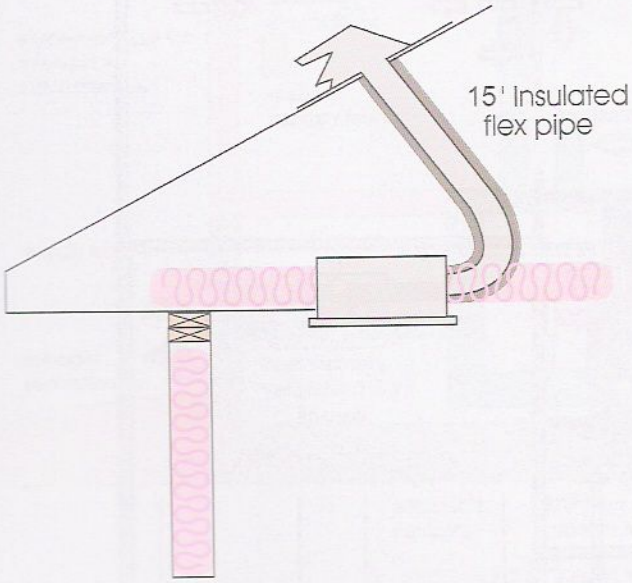


MAIN FLOOR PLAN

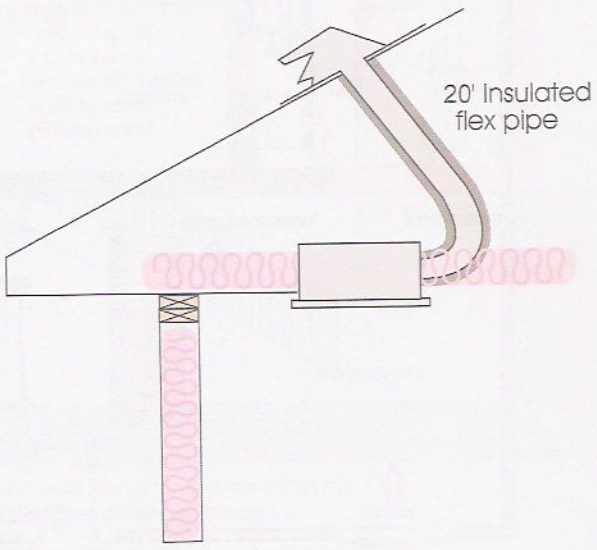


SECOND FLOOR PLAN

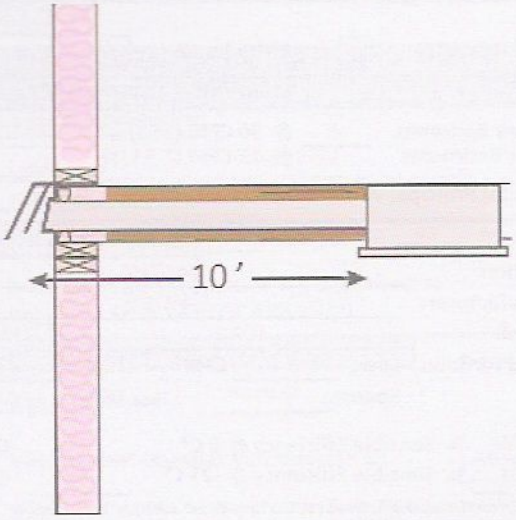
2nd Floor Bath Fan #1 Layout



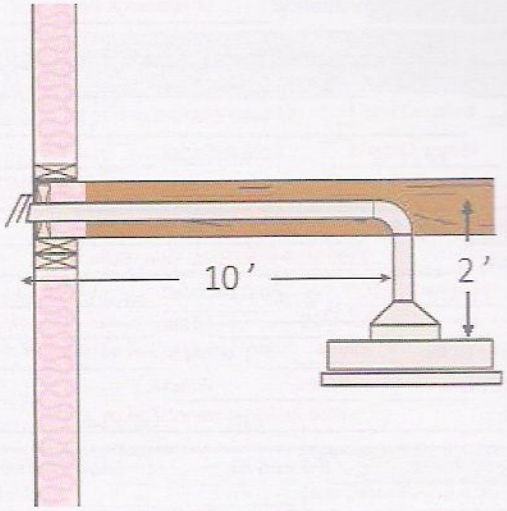
2nd Floor Bath #2 Layout



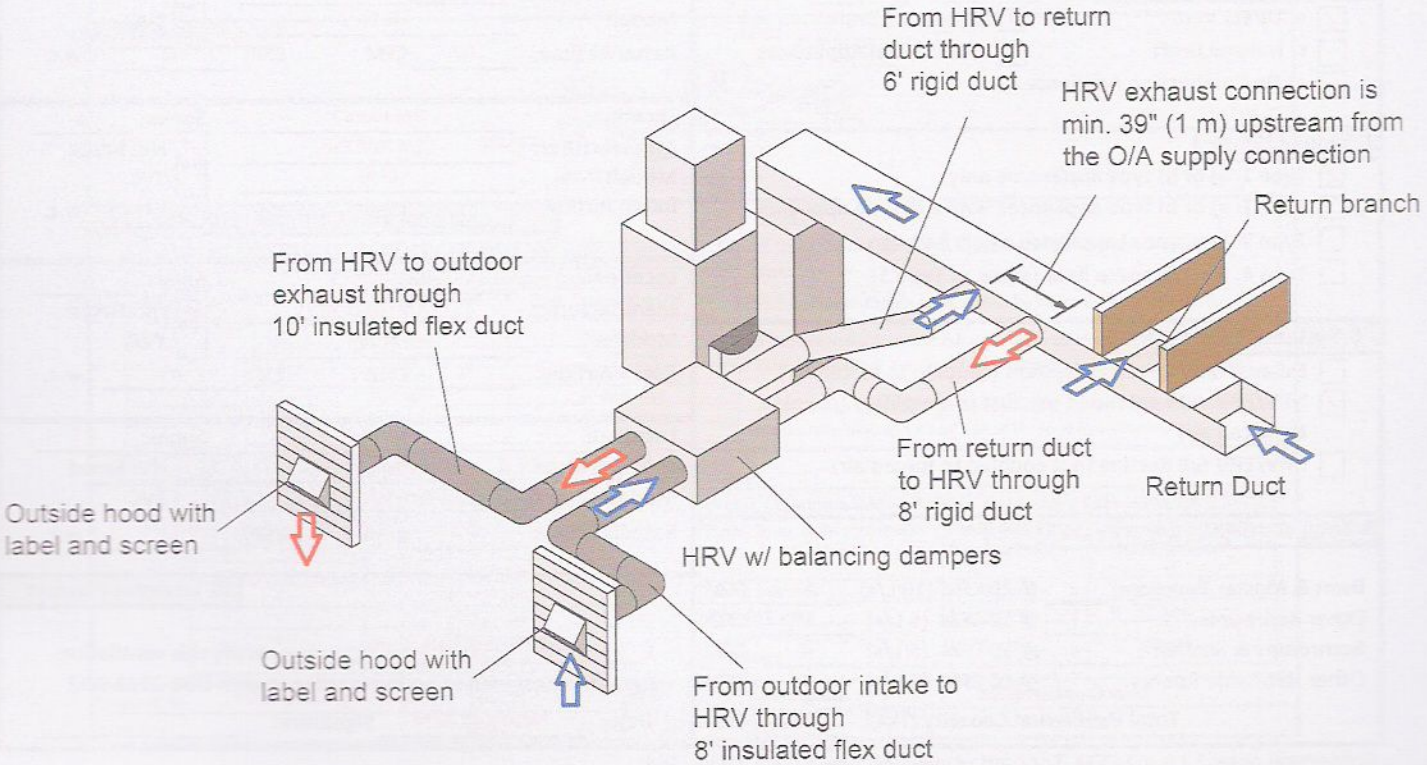
Main Floor Bath #3 Fan Layout



Range Hood Layout



Simplified Connection between HRV (Supply and Exhaust Side) and Furnace Return



RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location
Municipality: Mississauga Exercise 2
Civic Address: 1634 Belton Way

2. Builder
Name: Reid's Development
Address: 5586 David St.
City: Milton, Ontario Postal Code: L4W 6Y5
Ph: 905-568-4892 Fax: 905-568-4891

3. Designer
Name: HRAI
Address: 2350 Matheson Blvd. East, Suite 101
City: Mississauga, ON Postal Code: L4W 5G9
Ph: 905-602-4700 Fax: 905-602-1197
Designer BCIN: ##### HRAI #: ####
Firm BCIN: #####
E-mail: Web Address: www.HRAI.ca

4. Heating Systems
☑ Forced Air ☐ Non-Forced Air
☑ Gas ☐ Propane ☐ Other
☐ Oil ☐ Electricity

5. House Style
☑ One Dwelling Unit ☐ House with Two Dwelling Units
Ventilation System: ☐ Shared ☑ Dedicated

6. Combustion Appliances
☑ a) Direct Vent ☑ b) Induced Draft
☐ c) Natural Draft ☐ d) Solid Fuel Appliances
☐ e) No Combustion Appliances

7. Type of House
☑ Type 1: a) or b) type appliances only
☐ Type 2: a) or b) type appliances with a d) type appliance
☐ Type 3: any type c) appliance = part 6 design
☐ Type 4: electric space heat (same as Type 1)

8. System Design Option
☐ Exhaust only forced air system (coupled to forced air)
☑ HRV/ERV with extended exhaust or simplified (coupled to forced air)
☐ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	2	@ 20 CFM (10 L/s)	40	CFM
Other Bedrooms	3	@ 10 CFM (5 L/s)	30	CFM
Bathrooms & Kitchen	4	@ 10 CFM (5 L/s)	40	CFM
Other Habitable Rooms	5	@ 10 CFM (5 L/s)	50	CFM
Total Ventilation Capacity (TVC)			160	CFM

10. TVC System
☑ HRV/ERV ☐ Central Exhaust ☑ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	1	@ 30 CFM (15 L/s)	30	CFM
Other Bedrooms	3	@ 15 CFM (7.5 L/s)	45	CFM
Total Principal Ventilation Capacity (PVC)			75	CFM

12. Principal Ventilation Fan
Location: Basement
Manufacturer: DLM HRV
Model: H77 ☑ HVI Rated
Rated Airflow: Low: N/A CFM High: 86 CFM
Sones: N/A ESP: 0.2 " w.c.

66 % Sensible Efficiency @ 0 C° 47 CFM
55 % Sensible Efficiency @ -25 C° 64 CFM
(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)

Required Total Ventilation Capacity	160	CFM
Less Rated Principal Ventilation Capacity	86	CFM
Required Supplemental Ventilation Capacity	74	CFM

14. Additional Equipment

Location:	Bathroom 1	Sones:	1.0
Manufacturer:	DLM Bath Fan	☑ HVI Rated	
Model:	EF90	☑ TVC	
Rated Airflow:	90 CFM	ESP:	0.1 " w.c.

Location:	Bathroom 2	Sones:	1.0
Manufacturer:	DLM Bath Fan	☑ HVI Rated	
Model:	EF90	☐ TVC	
Rated Airflow:	90 CFM	ESP:	0.1 " w.c.

Location:	Bathroom 3	Sones:	0.5
Manufacturer:	DLM Bath Fan	☑ HVI Rated	
Model:	EF50	☐ TVC	
Rated Airflow:	50 CFM	ESP:	0.1 " w.c.

Location:	Kitchen	Sones:	8.5
Manufacturer:	DLM Range Hood	☐ HVI Rated	
Model:	CT Series Model 180	☐ TVC	
Rated Airflow:	218 CFM	ESP:	0.1 " w.c.

15. Designer Consent
I HRAI Certificate Holder certify this ventilation system is designed to be in accordance with OBC-2012 9.32
Date: August 20 2019 Signature: _____

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

 Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

RESET

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Basement

# of Bedrooms: 4

Design Airflow: 75 cfm ESP: 0.2 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment ☑ Coupled to Forced Air ☐ Not Coupled

☑ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

Make: DLM HRV

Model: H88

Equipment Rated Airflow: 110 cfm @ 0.2 " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: Exhaust 18' (39' max)

# of elbows used: Supply 4 (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	N/A	N/A	7"	8"	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:			7"	8"	(see Table 9.32.3.4.B)

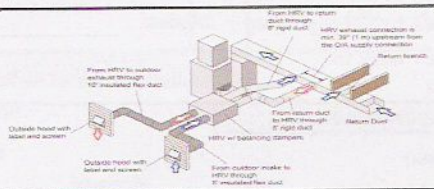
4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

Longest Total Duct Length from Grille to Outdoor Hood: N/A (69' max)

Total # of fittings used: N/A (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		N/A	N/A	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	N/A	N/A	(see Table 9.32.3.7.B)
	2) Other Bedrooms	N/A	N/A	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	N/A	N/A	(see Table 9.32.3.7.B)

5. Diagram



OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By: HRAI Certificate Holder	HRAI #: #####	Location:	Mississauga, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 2

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

RESET

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Bathroom 1

Design Airflow: 50 cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: DLM Bath Fan

Model: EF 90

Equipment Rated Airflow: 90 cfm @ 0.1 " w.c.

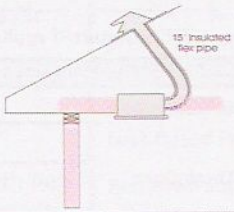
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 15' (29' max)

# of elbows used: 1 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	(see Table 9.32.3.5)

4. Diagram



1. Design Condition

Location: Bathroom 2

Design Airflow: D. Choice cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: DLM Bath Fan

Model: EF 90

Equipment Rated Airflow: 90 cfm @ 0.1 " w.c.

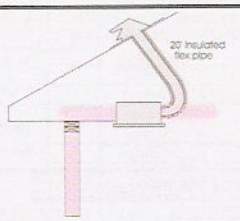
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 20' (29' max)

# of elbows used: 1 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	(see Table 9.32.3.5)

4. Diagram



OBC Table 9.32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By: HRAI Certificate Holder	HRAI #: ####	Location:	Mississauga, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 2

HRAI

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Bathroom 3

Design Airflow: D. Choice cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: BLM Bath Fan

Model: EF 90

Equipment Rated Airflow: 50 cfm @ 0.1 " w.c.

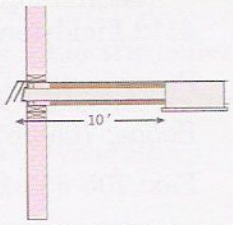
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 10' (29' max)

# of elbows used: 0 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	5"	6"	(see Table 9.32.3.5)

4. Diagram



1. Design Condition

Location: Kitchen

Design Airflow: D. Choice cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: DLM Range Hoods

Model: CT Series Model 180

Equipment Rated Airflow: 100 cfm @ 0.35 " w.c.

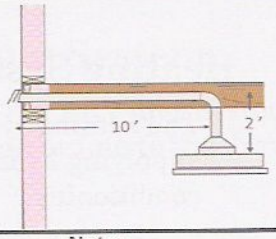
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 12' (29' max)

# of elbows used: 1 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	(see Table 9.32.3.5)

4. Diagram



OBC Table 9.32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By: HRAI Certificate Holder	HRAI #: ####	Location:	Mississauga, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 2

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

Exercise 3: ERV with Direct Ducted System (Huntsville)

Front View

Back View

Building Site

6812 Varga Dr.

Huntsville, Ontario, P1H 1B2

Builder

TLC Construction

4412 Fieldstone Dr.

Parry Sound, Ontario, P2A 1B4

Phone: 705-555-1200

Fax: 705-555-1201

Designing Firm

HRAI

2350 Matheson Blvd. East, Suite 101

Mississauga, Ontario, L4W 5G9

Phone: 905-602-4700

Fax: 905-602-1197

Web Address: www.HRAI.ca

Heating System:

The heating system shall be an electric boiler supplying hydronic baseboard radiators with no air conditioning.

House Style:

The house is a newly built, single-detached home with a dedicated ventilation system. The floor plans are provided on p79.

SB-12 Package

The house SB-12 package will be based around Zone 1 (<5000-degree days), "Compliance Packages for Electric Space Heating."

- Compliance package C2
- HRV/ERV 75% Sensible Recovery Efficiency

Combustion Appliances:

The house will contain the following combustion appliances:

- Electric boiler
- Electric water heater
- Wood Stove

Ventilation System:

The ventilation system is to be a fully ducted ERV with exhaust pickups in the bathroom and the kitchen and supply branches to all the bedrooms, every level, and the principal living area.

An appropriately sized ERV will achieve the principal ventilation capacity and the total ventilation capacity. The ERV shall be controlled by a wall switch located in the living room with at least 2 speeds of operation.

Duct System:

The ERV duct system shall be designed and sized according to the drawings on the following pages.

Exhaust Devices:

The house will contain the following exhaust devices:

- An ERV acting as the principal ventilation fan
- An electric clothes dryer in the basement

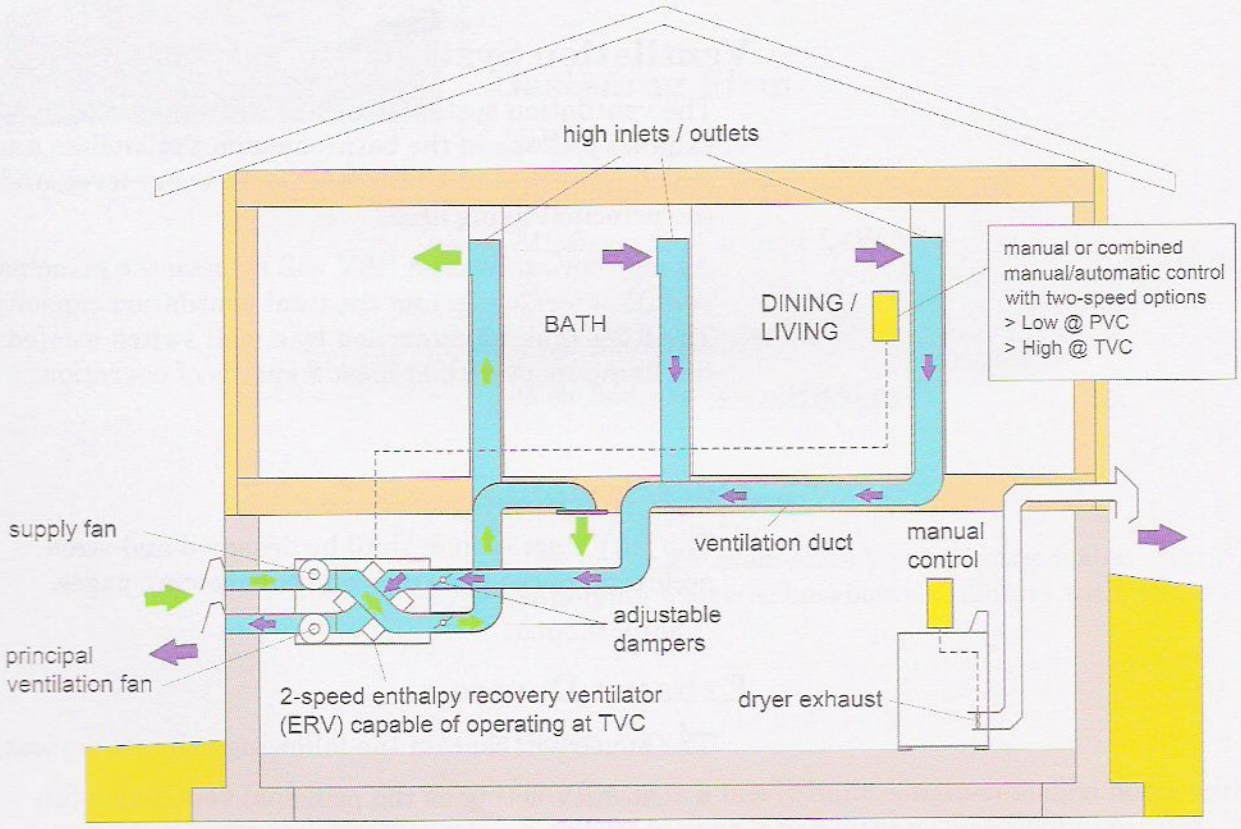
Control Devices:

The house will contain the following control devices:

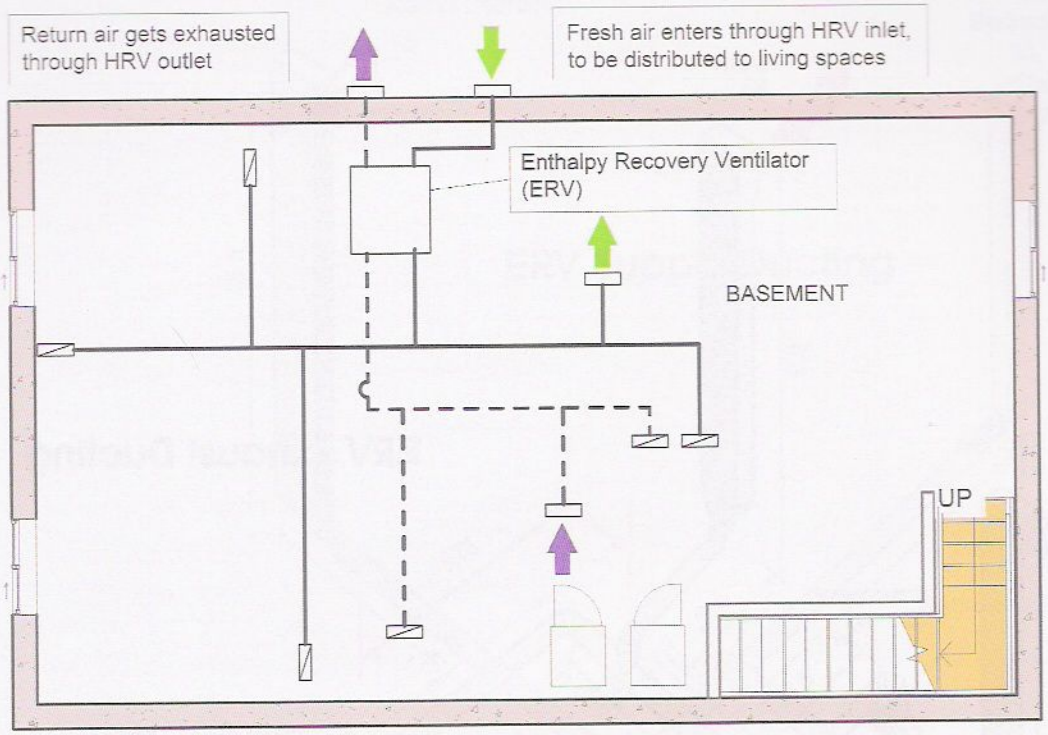
- A principal ventilation fan (PVF) control with at least 2 speeds of operation (e.g. dehumidistat located in the living room) labelled VENTILATION FAN
- A local high-speed timer located in each bathroom

Note: The ERV is balanced and does not create negative pressure during defrost.

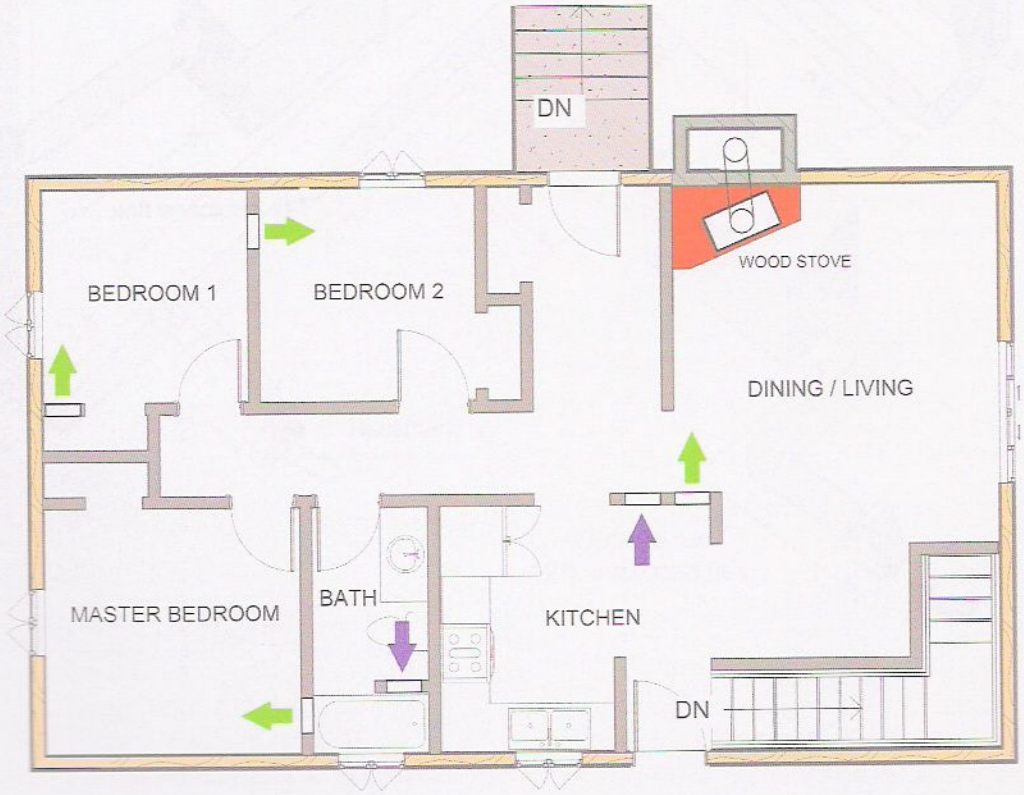
OBC 9.32.3.8 states the HRV/ERV being used with a wood stove does not create an imbalance in any operating mode.



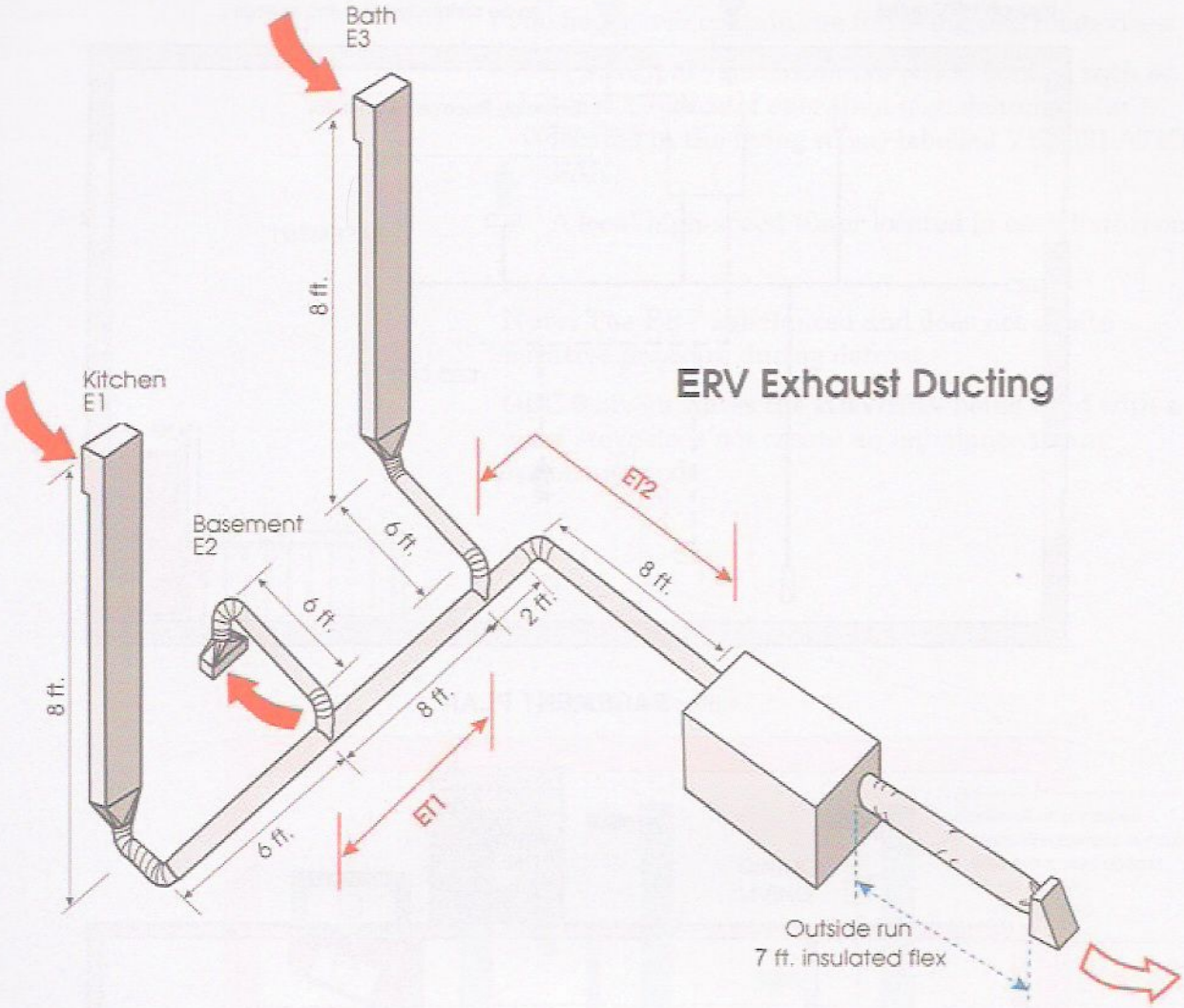
VENTILATION SYSTEM OVERVIEW

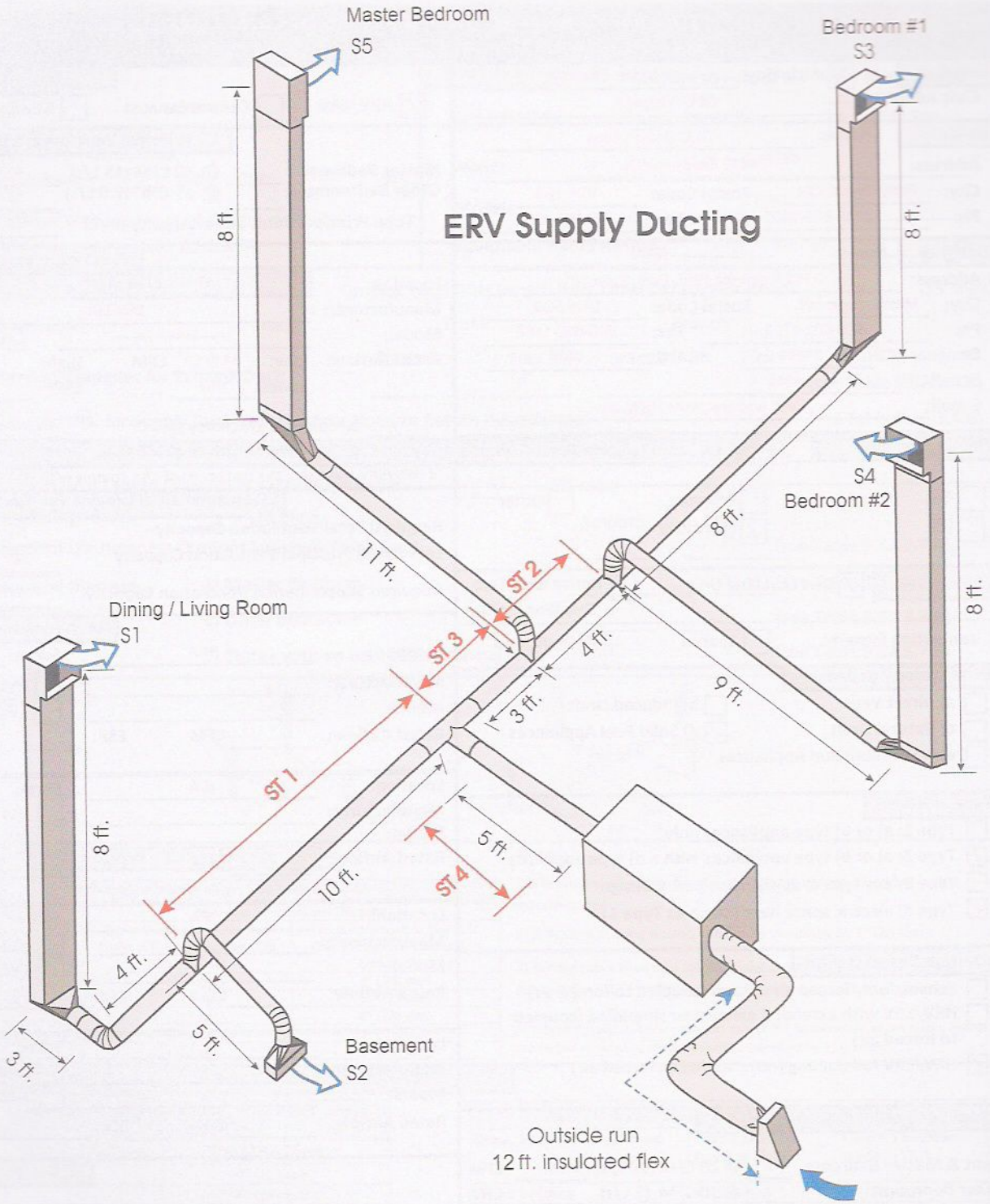


BASEMENT PLAN



MAIN FLOOR PLAN


ERV Exhaust Ducting
Bath
E3
Kitchen
E1
Basement
E2
8 ft.
6 ft.
6 ft.
6 ft.
8 ft.
2 ft.
8 ft.
8 ft.
ET2
ET1
Outside run
7 ft. insulated flex


ERV Supply Ducting
Master Bedroom
S5
Bedroom #1
S3
S4
Bedroom #2
Dining / Living Room
S1
Basement
S2
Outside run
12 ft. insulated flex
ST 1
ST 2
ST 3
ST 4
8 ft.
11 ft.
4 ft.
3 ft.
9 ft.
10 ft.
5 ft.

RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location
Municipality: Huntsville, Exercise 3
Civic Address: 6812 Varga Dr.

2. Builder
Name: TLC Construction
Address: 4412 Fieldstone Dr.
City: Parry Sound, ON Postal Code: P2A 1B4
Ph: 705-555-1200 Fax: 705-555-1201

3. Designer
Name: HRAI
Address: 2350 Matheson Blvd. East, Suite 101
City: Mississauga, ON Postal Code: L4W 5G9
Ph: 905-602-4700 Fax: 905-602-1197
Designer BCIN: ##### HRAI #: ####
Firm BCIN: ####
E-mail: Web Address: www.HRAI.ca

4. Heating Systems ☐ Forced Air ☑ Non-Forced Air

☐ Gas ☐ Propane ☐ Other
☐ Oil ☑ Electricity

5. House Style ☑ One Dwelling Unit ☐ House with Two Dwelling Units

Ventilation System: ☐ Shared ☑ Dedicated

6. Combustion Appliances

☐ a) Direct Vent ☐ b) Induced Draft
☐ c) Natural Draft ☑ d) Solid Fuel Appliances
☐ e) No Combustion Appliances

7. Type of House

☐ Type 1: a) or b) type appliances only
☑ Type 2: a) or b) type appliances with a d) type appliance
☐ Type 3: any type c) appliance = part 6 design
☑ Type 4: electric space heat (same as Type 1)

8. System Design Option

☐ Exhaust only forced air system (coupled to forced air)
☐ HRV/ERV with extended exhaust or simplified (coupled to forced air)
☑ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	2	@ 20 CFM (10 L/s)	40 CFM
Other Bedrooms	2	@ 10 CFM (5 L/s)	20 CFM
Bathrooms & Kitchen	2	@ 10 CFM (5 L/s)	20 CFM
Other Habitable Rooms	2	@ 10 CFM (5 L/s)	20 CFM
Total Ventilation Capacity (TVC)			100 CFM

10. TVC System

☑ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	1	@ 30 CFM (15 L/s)	30 CFM
Other Bedrooms	2	@ 15 CFM (7.5 L/s)	30 CFM
Total Principal Ventilation Capacity (PVC)			60 CFM

12. Principal Ventilation Fan

Location: Basement
Manufacturer: DLM ERV
Model: E240 ☑ HVI Rated
Rated Airflow: Low: 54 to 66 CFM High: 140 CFM
Sones: N/A ESP: 0.2 " w.c.

77 % Sensible Efficiency @ 0 C° 64 CFM
70 % Sensible Efficiency @ -25 C° 67 CFM
(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)

Required Total Ventilation Capacity	100 CFM
Less Rated Principal Ventilation Capacity	140 CFM
Required Supplemental Ventilation Capacity	-40 CFM

14. Additional Equipment

Location: N/A Sones: ____ ☐ HVI Rated ☐ TVC
Manufacturer: ____
Model: ____
Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: N/A Sones: ____ ☐ HVI Rated ☐ TVC
Manufacturer: ____
Model: ____
Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: N/A Sones: ____ ☐ HVI Rated ☐ TVC
Manufacturer: ____
Model: ____
Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: N/A Sones: ____ ☐ HVI Rated ☐ TVC
Manufacturer: ____
Model: ____
Rated Airflow: ____ CFM ESP: ____ " w.c.

15. Designer Consent

I HRAI Certificate Holder certify this ventilation system is designed to be in accordance with OBC-2012 9.32

Date: August 20 2019 Signature: ____

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

 Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Basement

# of Bedrooms: 3

Design Airflow: 100 cfm ESP: 0.2 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

☐ Coupled to Forced Air ☑ Not Coupled

☑ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

Make: DLM ERV

Model: E240

Equipment Rated Airflow: 100 cfm @ 0.6 " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: 39' (39' max)

# of elbows used: 3 (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	5"	6"	4"	5"	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:	N/A	N/A			(see Table 9.32.3.4.B)

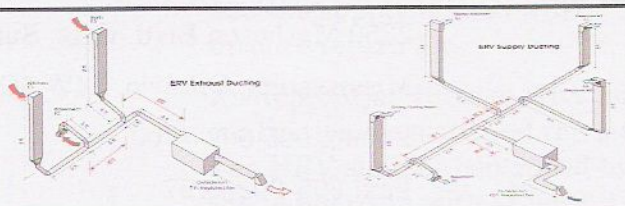
4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

Longest Total Duct Length from Grille to Outdoor Hood: 40' (69' max)

Total # of fittings used: 8 (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		7"	8"	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	4"	5"	(see Table 9.32.3.7.B)
	2) Other Bedrooms	3"	4"	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	4"	5"	(see Table 9.32.3.7.B)

5. Diagram



OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

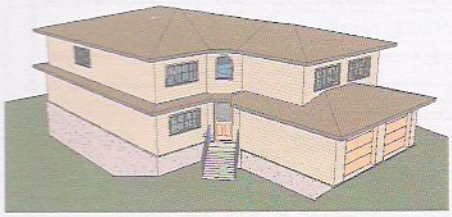
Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By: HRAI Certificate Holder	HRAI #: ####	Location:	Huntsville, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 3

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

Exercise 4: HRV with Extended Exhaust System (Kingston)



Front View

Back View

Building Site

2625 Stone Cres.

Kingston, Ontario, K7G 0B9

Builder

FB Design

6894 Hillside Dr.

Kingston, Ontario, K7G 0A2

Phone: 613-258-6010

Fax: 613-258-6011

Designing Firm

HRAI

2350 Matheson Blvd. East, Suite 101

Mississauga, Ontario, L4W 5G9

Phone: 905-602-4700

Fax: 905-602-1197

Web Address: www.HRAI.ca

Heating System:

The heating system shall be a natural gas forced air furnace with air conditioning. The heating system layout has been provided on the floor plans below.

House Style:

The house is a newly built, single-detached home with a dedicated ventilation system. The floor plans are provided on p87.

SB-12 Package

The house SB-12 package will be based around Zone 1 (<5000-degree days), "Compliance Packages for Space Heating Equipment with AFUE ≥96%."

- Compliance package A1
- HRV/ERV 75% Sensible Recovery Efficiency

Combustion Appliances:

The house will contain the following combustion appliances:

- Direct vent 92% natural gas furnace
- Induced Draft (power vent) natural gas water heater

Ventilation System:

The ventilation system is to be an extended exhaust HRV system with exhaust pickups in each bathroom, and the supply branch will be connected directly to the furnace return air.

An appropriately sized HRV will meet the principal ventilation capacity and the total ventilation capacity. The HRV shall be controlled by a wall switch located in the living room with at least 2 speeds of operation.

This design is a very common HRV system being installed today.

Duct System:

The HRV duct system shall be designed and sized according to the drawings on the following pages.

Exhaust Devices:

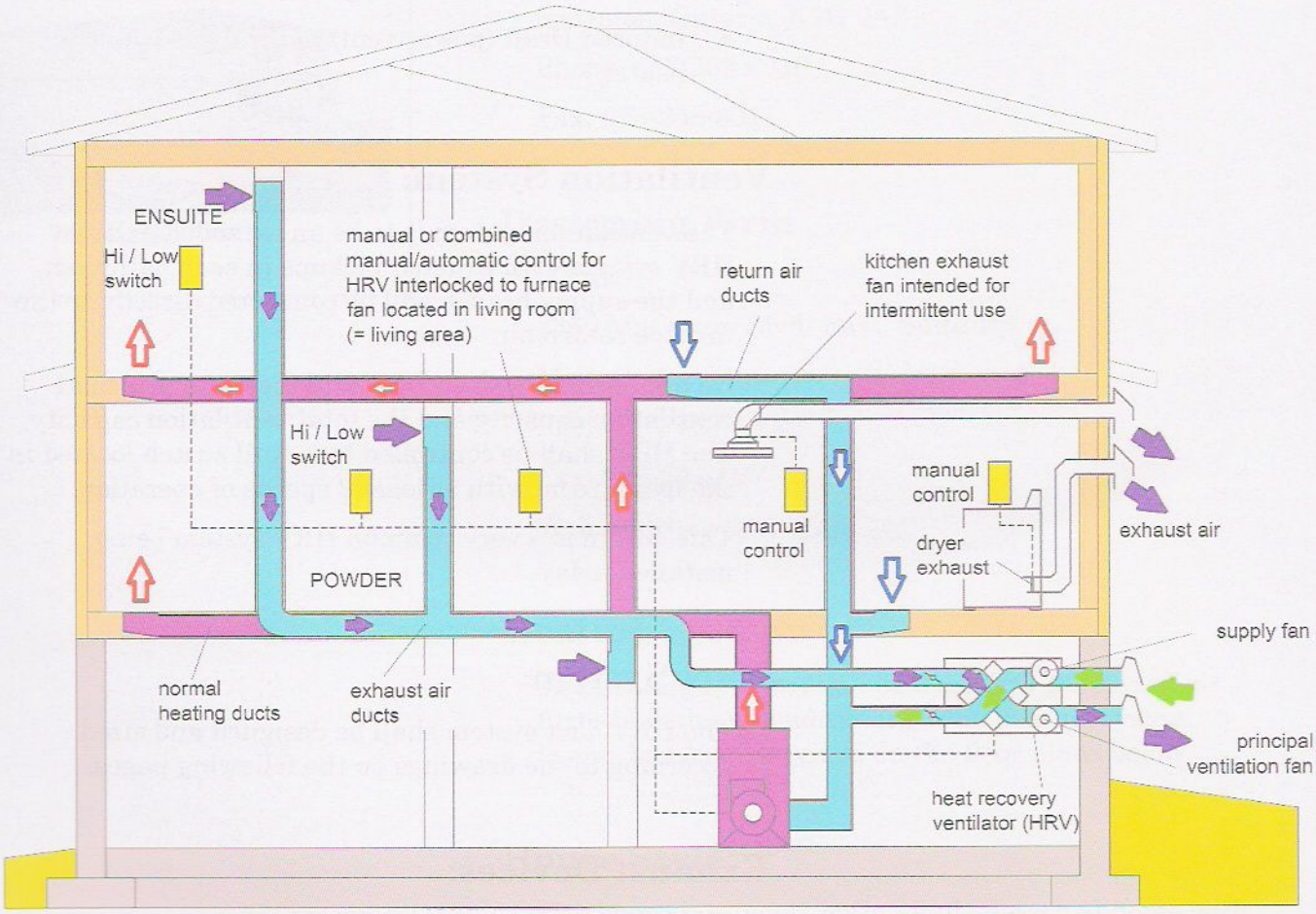
The house will contain the following exhaust devices:

- An HRV acting as the principal ventilation
- A range hood in the kitchen (CT Series Model 200)
- An electric clothes dryer on the main floor

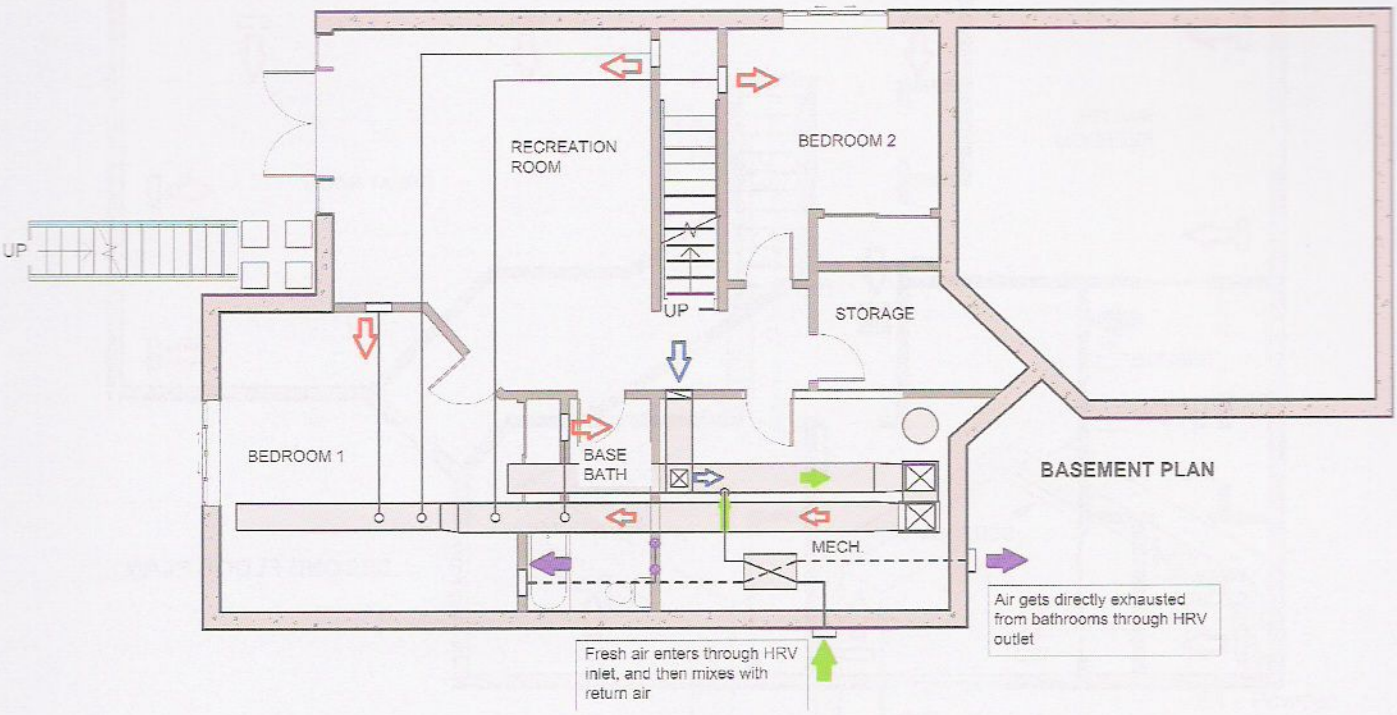
Control Devices:

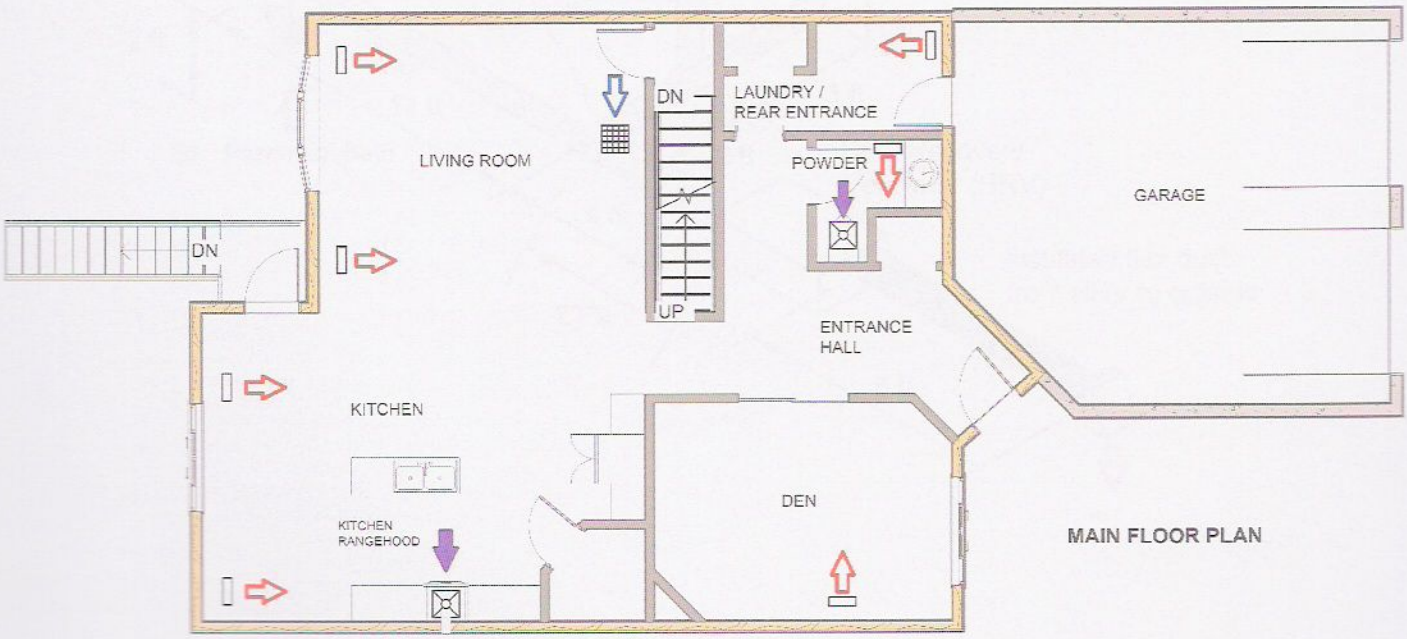
The house will contain the following control devices:

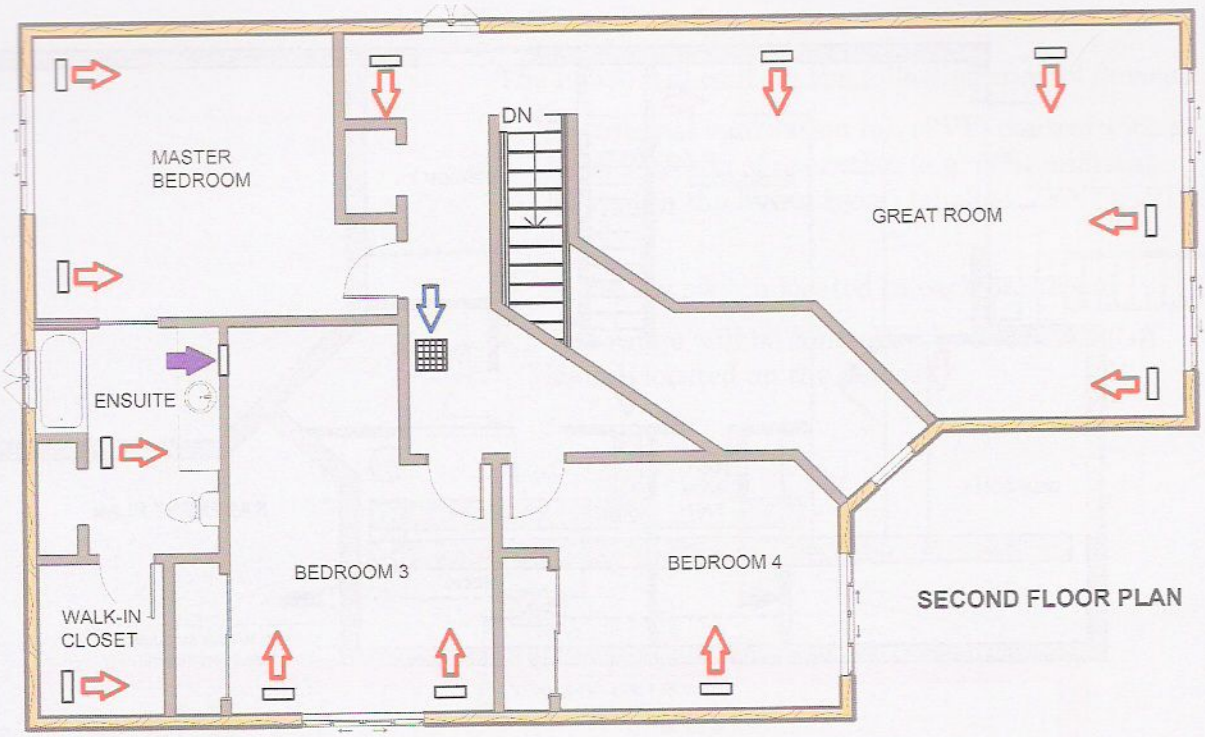
- A principal ventilation fan (PVF) control with at least 2 speeds of operation (e.g. dehumidistat located in the living room) labelled VENTILATION FAN
- A Hi/Low switch located in each bathroom
- The range will be controlled by a local On/Off switch located on the device



VENTILATION SYSTEM OVERVIEW

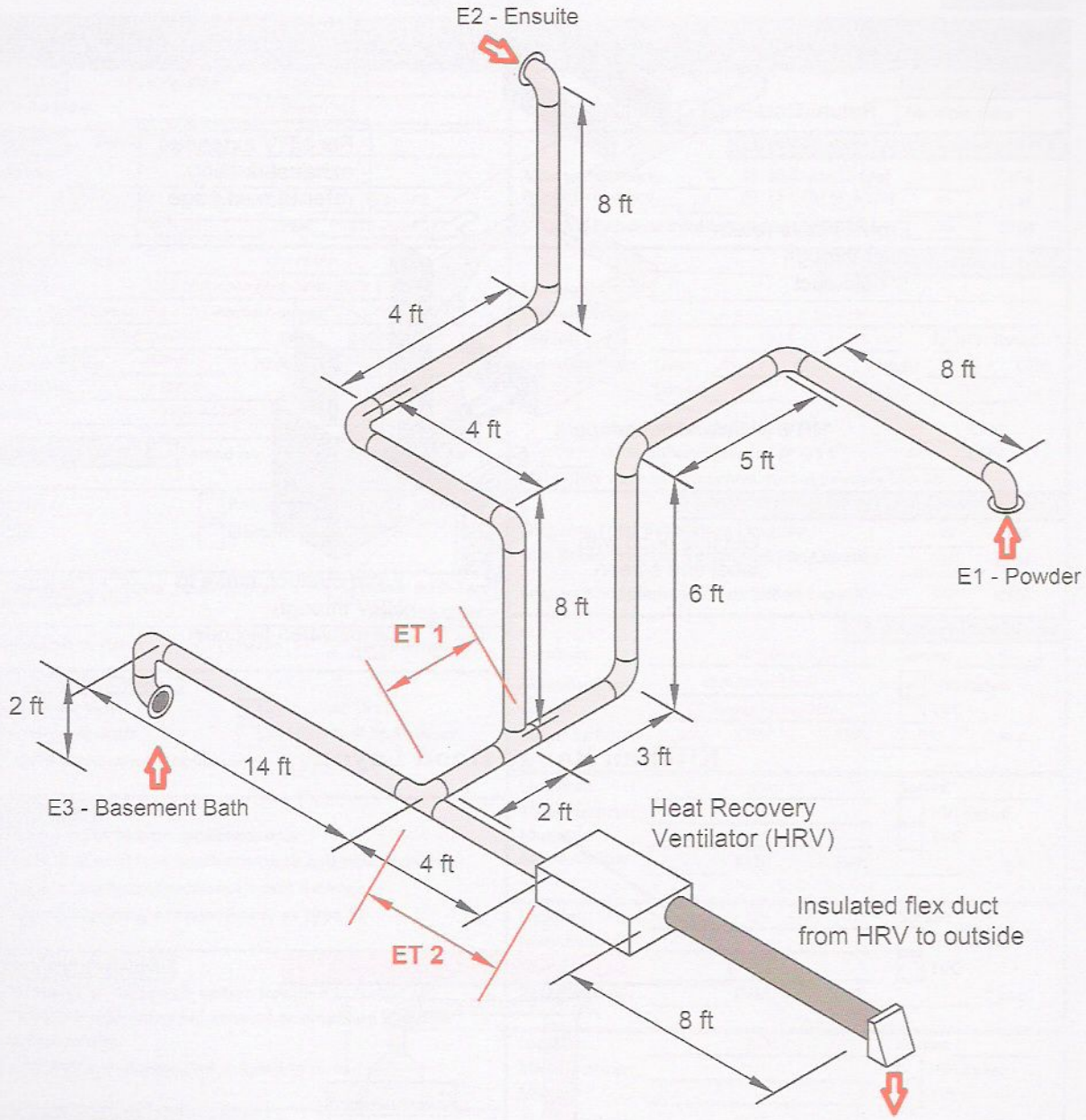

RECREATION ROOM
BEDROOM 2
UP
STORAGE
UP
BEDROOM 1
BASE BATH
MECH.
BASEMENT PLAN
Air gets directly exhausted from bathrooms through HRV outlet
Fresh air enters through HRV inlet, and then mixes with return air


DN
LAUNDRY / REAR ENTRANCE
LIVING ROOM
POWDER
GARAGE
DN
UP
ENTRANCE HALL
KITCHEN
DEN
KITCHEN RANGEHOOD
MAIN FLOOR PLAN

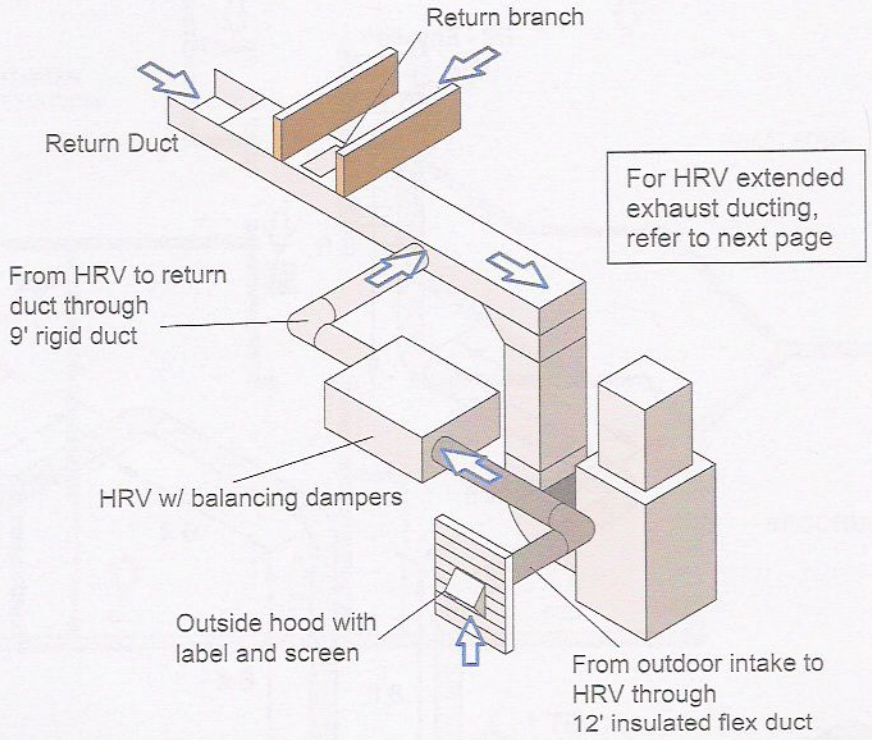


SECOND FLOOR PLAN

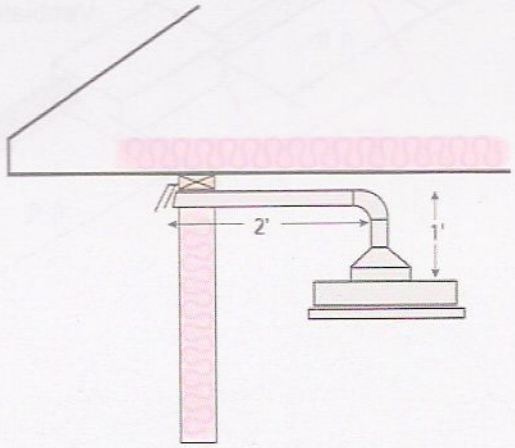
HRV Extended Exhaust Ducting



HRV Supply Side and Furnace Return



Kitchen Range Hood Layout



RESET

RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location
Municipality: Kingston, Exercise 4
Civic Address: 2625 Stone Cres.

2. Builder
Name: FB Design
Address: 6894 Hillside Dr.
City: Kingston, ON Postal Code: K7G 0A2
Ph: 613-258-6010 Fax: 613-258-6011

3. Designer
Name: HRAI
Address: 2350 Matheson Blvd. East, Suite 101
City: Mississauga, ON Postal Code: L4W 5G9
Ph: 905-602-4700 Fax: 905-602-1197
Designer BCIN: ##### HRAI #: ####
Firm BCIN: #####
E-mail: Web Address: www.HRAI.ca

4. Heating Systems
☑ Forced Air ☐ Non-Forced Air

☑ Gas ☐ Propane ☐ Other
☐ Oil ☐ Electricity

5. House Style
☑ One Dwelling Unit ☐ House with Two Dwelling Units

Ventilation System: ☐ Shared ☑ Dedicated

6. Combustion Appliances
☑ a) Direct Vent ☑ b) Induced Draft
☐ c) Natural Draft ☐ d) Solid Fuel Appliances
☐ e) No Combustion Appliances

7. Type of House
☑ Type 1: a) or b) type appliances only
☐ Type 2: a) or b) type appliances with a d) type appliance
☐ Type 3: any type c) appliance = part 6 design
☐ Type 4: electric space heat (same as Type 1)

8. System Design Option
☐ Exhaust only forced air system (coupled to forced air)
☑ HRV/ERV with extended exhaust or simplified (coupled to forced air)
☐ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	1	@ 20 CFM (10 L/s)	20	CFM
Other Bedrooms	4	@ 10 CFM (5 L/s)	40	CFM
Bathrooms & Kitchen	4	@ 10 CFM (5 L/s)	40	CFM
Other Habitable Rooms	5	@ 10 CFM (5 L/s)	50	CFM
Total Ventilation Capacity (TVC)			150	CFM

10. TVC System
☑ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	1	@ 30 CFM (15 L/s)	30	CFM
Other Bedrooms	4	@ 15 CFM (7.5 L/s)	60	CFM
Total Principal Ventilation Capacity (PVC)			90	CFM

12. Principal Ventilation Fan
Location: Basement
Manufacturer: DLM HRV
Model: H155 ☑ HVI Rated
Rated Airflow: Low: 81 to 99 CFM High: 183 CFM
Sones: N/A ESP: 0.2 " w.c.

75 % Sensible Efficiency @ 0 C° 65 CFM
70 % Sensible Efficiency @ -25 C° 64 CFM
(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)

Required Total Ventilation Capacity	150	CFM
Less Rated Principal Ventilation Fan Capacity	183	CFM
Required Supplemental Ventilation Capacity	-33	CFM

14. Additional Equipment
Location: Kitchen Sones: 6.5
Manufacturer: DLM Range Hood ☑ HVI Rated
Model: CT Series Model 200 ☐ TVC
Rated Airflow: 200 CFM ESP: 0.1 " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

Location: N/A Sones:
Manufacturer: ☐ HVI Rated
Model: ☐ TVC
Rated Airflow: CFM ESP: " w.c.

15. Designer Consent
I HRAI Certificate Holder certify this ventilation system is designed to be in accordance with OBC-2012 9.32
Date: August 20 2019 Signature:

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

HRAI Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Basement

# of Bedrooms: 5

Design Airflow: 150 cfm ESP: 0.2 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

☑ Coupled to Forced Air ☐ Not Coupled

☑ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

Make: DLM HRV

Model: H155

Equipment Rated Airflow: 150 cfm @ 0.41 " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: E-2 38' (39' max)

# of elbows used: Exhaust 4 (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	5"	6"	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:		7"		8"	(see Table 9.32.3.4.B)

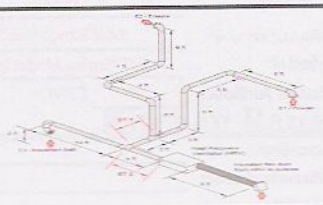
4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

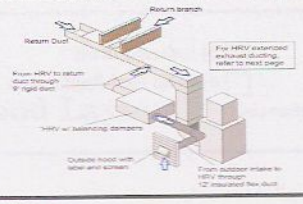
Longest Total Duct Length from Grille to Outdoor Hood: N/A (69' max)

Total # of fittings used: N/A (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		N/A	N/A	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	N/A	N/A	(see Table 9.32.3.7.B)
	2) Other Bedrooms	N/A	N/A	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	N/A	N/A	(see Table 9.32.3.7.B)

5. Diagram





OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By: HRAI Certificate Holder	HRAI #: ####	Location:	Kingston, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 4

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: Kitchen

Design Airflow: D. Choice cfm ESP: 0.1 " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: DLM

Model: CT Series Model 200

Equipment Rated Airflow: 100 cfm @ 0.31 " w.c.

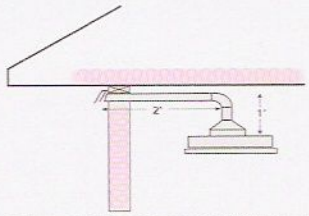
3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: 3' (29' max)

# of elbows used: 1 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	6"	7"	(see Table 9.32.3.5)

4. Diagram



1. Design Condition

Location: N/A

Design Airflow: N/A cfm ESP: N/A " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: N/A

Model: N/A

Equipment Rated Airflow: N/A cfm @ N/A " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: N/A (29' max)

# of elbows used: N/A (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	N/A	N/A	(see Table 9.32.3.5)

4. Diagram

OBC Table 9.32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By: HRAI Certificate Holder	HRAI #: #####	Location:	Kingston, Ontario
Signature:	Date: August 20 2019	Official Use:	Exercise 4

HRAI

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

NOTES

WORKSHEETS, TABLES & CHARTS

Table of Contents

RESIDENTIAL MECHANICAL VENTILATION DESIGN SUMMARY

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Location

Municipality: ________

Civic Address: ________

2. Builder

Name: ________

Address: ________

City: ________ Postal Code: ________

Ph: ________ Fax: ________

3. Designer

Name: ________

Address: ________

City: ________ Postal Code: ________

Ph: ________ Fax: ________

Designer BCIN: ________ HRAI #: ________

Firm BCIN: ________

E-mail: ________

4. Heating Systems ☐ Forced Air ☐ Non-Forced Air

☐ Gas ☐ Propane ☐ Other

☐ Oil ☐ Electricity

5. House Style ☐ One Dwelling Unit ☐ House with Two Dwelling Units

Ventilation System: ☐ Shared ☐ Dedicated

6. Combustion Appliances

☐ a) Direct Vent ☐ b) Induced Draft

☐ c) Natural Draft ☐ d) Solid Fuel Appliances

☐ e) No Combustion Appliances

7. Type of House

☐ Type 1: a) or b) type appliances only

☐ Type 2: a) or b) type appliances with a d) type appliance

☐ Type 3: any type c) appliance = part 6 design

☐ Type 4: electric space heat (same as Type 1)

8. System Design Option

☐ Exhaust only forced air system (coupled to forced air)

☐ HRV/ERV with extended exhaust or simplified (coupled to forced air)

☐ HRV/ERV full ducting (not coupled to forced air)

9. Total Ventilation Capacity (TVC)

Bsmt & Master Bedroom	____	@ 20 CFM (10 L/s)	____	CFM
Other Bedrooms	____	@ 10 CFM (5 L/s)	____	CFM
Bathrooms & Kitchen	____	@ 10 CFM (5 L/s)	____	CFM
Other Habitable Rooms	____	@ 10 CFM (5 L/s)	____	CFM
		Total Ventilation Capacity (TVC)	____	CFM

10. TVC System

☐ HRV/ERV ☐ Central Exhaust ☐ Multiple Fans

11. Principal Ventilation Capacity (PVC)

Master Bedroom	____	@ 30 CFM (15 L/s)	____	CFM
Other Bedrooms	____	@ 15 CFM (7.5 L/s)	____	CFM
		Total Principal Ventilation Capacity (PVC)	____	CFM

12. Principal Ventilation Fan

Location: ________

Manufacturer: ________

Model: ________ ☐ HVI Rated

Rated Airflow: Low: ____ CFM High: ____ CFM

Sones: ____ ESP: ____ " w.c.

____ % Sensible Efficiency @ 0 C° ____ CFM

____ % Sensible Efficiency @ -25 C° ____ CFM

(If HRV/ERV was used, the system must also comply with SB-12)

13. Supplemental Exhaust Fan Capacity (SEF)

Required Total Ventilation Capacity ____ CFM

Less Rated Principal Ventilation Capacity ____ CFM

Required Supplemental Ventilation Capacity ____ CFM

14. Additional Equipment

Location: ________ Sones: ____

Manufacturer: ________ ☐ HVI Rated

Model: ________ ☐ TVC

Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: ________ Sones: ____

Manufacturer: ________ ☐ HVI Rated

Model: ________ ☐ TVC

Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: ________ Sones: ____

Manufacturer: ________ ☐ HVI Rated

Model: ________ ☐ TVC

Rated Airflow: ____ CFM ESP: ____ " w.c.

Location: ________ Sones: ____

Manufacturer: ________ ☐ HVI Rated

Model: ________ ☐ TVC

Rated Airflow: ____ CFM ESP: ____ " w.c.

15. Designer Consent

I ________ certify this ventilation system is designed to be in accordance with OBC-2012 9.32

Date: ________ Signature: ________

Conversion note: 1 L/s = 2 CFM (For hard conversion, use 1 L/s = 2.118 CFM)

HRAI

 Residential Mechanical Ventilation Design - OBC-2012 9.32 r 10/19

OBC DUCT SIZING - PRINCIPAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: _____

# of Bedrooms: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

☐ Coupled to Forced Air ☐ Not Coupled

☐ HRV/ERV ☐ Exhaust Fan ☐ Inline Fan

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Duct Sizing using Table 9.32.3.4.B

Longest Total Duct Length from Grille to Outdoor Hood: _____ (39' max)

# of elbows used: _____ (4 max)

	Trunk		Branch		
	Smooth	Flex	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	_____	_____	(see Table 9.32.3.4.B)
Min. Required Dia. for Supply Duct from Outdoor Hood to Return if applicable:		_____		_____	(see Table 9.32.3.4.B)

4. Supply Duct Sizing using Table 9.32.3.7.A & 9.32.3.7.B - For Systems not coupled with Forced Air

Longest Total Duct Length from Grille to Outdoor Hood: _____ (69' max)

Total # of fittings used: _____ (8 max)

		Smooth	Flex	
Min. Required Diameter for Outdoor Supply & Trunk Duct:		_____	_____	(see Table 9.32.3.7.A)
Min. Required Diameter for Supply Branch Duct To:	1) Master Bedroom	_____	_____	(see Table 9.32.3.7.B)
	2) Other Bedrooms	_____	_____	(see Table 9.32.3.7.B)
	3) Storey with no bedrooms or living area	_____	_____	(see Table 9.32.3.7.B)

5. Diagram

OBC Table 9.32.3.4.B - For Reference

Principal Exhaust Fan Duct Size Table 9.32.3.4.B

Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

3) Where more than one exhaust inlet is connected to the principal exhaust fan (PEF), the branch ducts may be reduced by 1" (25 mm)

4) Where the supply and/or exhaust side of PEF is connected to the return side of the forced air heating, the duct shall be increased by 1" (25mm).

OBC Table 9.32.3.7.A and 9.32.3.7.B - For Reference

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A

Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B

Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

OBC DUCT SIZING - SUPPLEMENTAL FAN DUCT

for design and performance of residential ventilation systems to OBC 2012 - 9.32

1. Design Condition

Location: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: _____ (29' max) 14/24

# of elbows used: 2 (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	(see Table 9.32.3.5)

4. Diagram

---

1. Design Condition

Location: _____

Design Airflow: _____ cfm ESP: _____ " w.c.

Note: external static pressure of the fan needs to be in accordance with OBC 9.32.3.9.(3)

2. Equipment

Make: _____

Model: _____

Equipment Rated Airflow: _____ cfm @ _____ " w.c.

3. Supplemental Exhaust Duct Sizing using Table 9.32.3.5

Total Duct Length: _____ (29' max)

# of elbows used: _____ (4 max)

	Smooth	Flex	
Min. Required Diameter for Exhaust Duct:	_____	_____	(see Table 9.32.3.5)

4. Diagram

OBC Table 9,32.3.5 - For Reference

Supplemental Exhaust Duct Size Table 9.32.3.5

Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Note:

1) The duct shall always be at least as large as recommended by the manufacturer

2) If flexible ducting is used, it shall be increased by 1" (25 mm).

Prepared By:	HRAI #:	Location:
Signature:	Date:	Official Use:

 Residential Mechanical Ventilation Design - NBC-2015 9.32 r 08/19

OBC Section 9.32 Ventilation System Design Tables

Natural Ventilation Table 9.32.2.1	
Location	Minimum Unobstructed area
Bathrooms or water closet rooms	0.97 ft^2 (0.09 m^2)
Unfinished basement spaces	0.2% of the floor area
All other finished rooms	3 ft^2 (0.28 m^2) per room or combination of rooms

Total Ventilation Capacity Table 9.32.3.3		
Room	Capacity	
	cfm	L/s
Master bedrooms[1]	20	10
Other bedrooms	10	5
Living Room[2]	10	5
Dining Room[2]	10	5
Kitchen	10	5
Family Room[2]	10	5
Recreation Room	10	5
Basement area[3]	20	10
Other habitable rooms[4]	10	5
Bathroom or Water Closet	10	5
Laundry room	10	5
Utility Room	10	5

Notes:

1) At least one bedroom in each dwelling shall be designated as the master bedroom.
2) Combined rooms (e.g. living/dining) shall be allowed for as if each space were an individual room.
3) Where the basement incorporates habitable rooms, each room shall be assigned airflow according to the room use.
4) Where a basement room exceeds 2/3 of the total basement floor area, it shall be assigned 20 cfm (10 L/s).
5) Habitable rooms do not include rooms intended solely for access, egress, storage or service equipment.

Principal Exhaust Fan Capacity Table 9.32.3.4.A		
Number of Bedrooms	Capacity	
	cfm	L/s
1	30	15
2	45	22.5
3	60	30
4	75	37.5
5	90	45
More than 5	Part 6 Design	

Principal Exhaust Fan Duct Size Table 9.32.3.4.B		
Number of Bedrooms in House or Dwelling Unit	Minimum Exhaust Duct Diameter	
	Ducts Connected to Inlet and Outlet of Principal Exhaust Fan Smooth Duct	Ducts Connected to One Side Only of Principal Exhaust Fan Smooth Duct
1	4" (100 mm)	4" (100 mm)
2	5" (125 mm)	5" (125 mm)
3	5" (125 mm)	6" (150 mm)
4	6" (150 mm)	6" (150 mm)
5	6" (150 mm)	6" (150 mm)

Supplemental Exhaust Duct Size Table 9.32.3.5		
Fan Capacity, cfm	Ducts Connected to Inlet and Outlet of Exhaust Fan	Ducts Connected to One Side Only of Exhaust Fan
0 - 50	5" (125 mm)	5" (125 mm)
51 - 100	6" (150 mm)	6" (150 mm)

Outdoor Air Supply and Main Trunk Duct Diameter Table 9.32.3.7.A	
Number of Bedrooms	Trunk Duct Diameter
1	6" (150 mm)
2	6" (150 mm)
3	7" (175 mm)
4	7" (175 mm)
5	7" (175 mm)

Minimum Branch Supply Duct Diameter Table 9.32.3.7.B		
Room, Space or Storey Served	1 and 2 Bedroom Dwelling Units	3,4 and 5 Bedroom Dwelling Units
Master bedroom	4" (100 mm)	4" (100 mm)
Other bedrooms	3" (75 mm)	3" (75 mm)
A storey with no bedrooms or living area	3" (75 mm)	4" (100 mm)

External Static Pressure Table 9.32.3.9.A		
Fan configuration (application)	Minimum External Static Pressure	
	Inches Water Column	Pascals
Through the wall fans	.03" w.c.	7.5 Pa
Fans with ducts on one side only (e.g. a bathroom fan)	.1" w.c.	25 Pa
Fans with ducts on both sides (e.g. a central exhaust fan or HRV)	.2" w.c.	50 Pa

Fan Sound Rating Table 9.32.3.9.B		
Fan Application	Maximum Sound Rating (sones)	
	According to HVI 915	According to CAN/CSA-C260-M
Principal Ventilation Exhaust Fan	2.5 sones	2.0 sones
Supplemental fans installed in bathrooms and their make-up air fans	3.5 sones	2.5 sones
Supplemental fans installed in kitchens and their make-up air fans	No rating required	No rating required

Supply Duct Insulation for Ducts over 10' Long Table 9.32.3.10.A	
Outside Winter Design Temperature °F (°C)	**Minimum R-Value (RSI)**
19 to 12 (–7 to –11)	R3 (RSI 0.5)
10 to 1 (–12 to –17)	R5 (RSI 0.9)
0 to -11 (–18 to –24)	R7 (RSI 1.2)
-13 to -20 (–25 to –29)	R8 (RSI 1.4)
-22 to -29 (–30 to –34)	R10 (RSI 1.8)
-31 (–35) and colder	R12 (RSI 2.1)

Rectangular Equivalent Duct Sizes Table 9.32.3.10.B (Imperial)				
Required Round Duct Size (in.)	Permitted Equivalent Rectangular Duct Size, inches			
	Stack Duct	4-inch depth	5-inch depth	6-inch depth
3	3-1/4 x 10	2-1/4 x 4	-------	--------
4	3-1/4 x 10	3-1/2 x 4	3 x 5	3 x 6
5	3-1/4 x 10	5 x 4	4 x 5	3-1/4 x 6
6	3-1/4 x 12	8 x 4	6 x 5	5 x 6
7	3-1/4 x 14	11 x 4	8 x 5	7 x 6
>7	Design to Part 6			

Rectangular Equivalent Duct Sizes Table 9.32.3.10.B (Metric)				
Required Round Duct Size (mm)	Permitted Equivalent Rectangular Duct Size, mm			
	Stack Duct	100 mm depth	125 mm depth	150 mm depth
75	82 x 250	57 x 100	-------	--------
100	82 x 250	89 x 100	75 x 125	75 x 150
125	82 x 250	125 x 100	100 x 125	89 x 150
150	82 x 300	200 x 100	150 x 125	125 x 150
175	82 x 350	275 x 100	200 x 125	175 x 150
>175	Design to Part 6			

1) These equivalent sizes are for equal friction and capacity only – not for equal cross-sectional area or velocity.

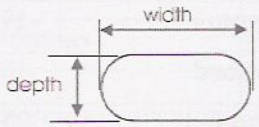
Oval Equivalent Duct Sizes Table (Imperial) Note 1		
Round Duct Diameter (Inches)	Oval Equivalent duct sizes, inches	
	Manufacturer's Listed Diameter Note 2	Oval Size Note 3
3	4	3 x 4-9/16
4	5	3 x 6-1/8
5	6	3 x 7-3/4
6	8	3 x 10-7/8
7	Note 4	

Oval Equivalent Duct Sizes Table (Metric) Note 1		
Round Duct Diameter (mm)	Oval Equivalent duct sizes, mm	
	Manufacturer's Listed Diameter Note 2	Oval Size Note 3
75	100	75 x 114
100	125	75 x 153
125	150	75 x 194
150	200	75 x 272
175	Note 4	

1) These equivalent sizes are for equal friction and capacity only – not for equal cross-sectional area or velocity.

2) Some manufacturers refer to the size of an oval pipe based on the equivalent circumference of the corresponding round pipe, not its air handling ability. For example, 5" round pipe and 5" oval pipe will have the same measured circumference, not the same air handling ability.

3) Oval size data is based on commonly available manufacturer's sizes and is subject to change.



4) For sizes not listed the equivalent diameter given by the following formula must be at least as large as the round duct diameter:

$$D_{equiv} = 1.55\ A^{.625} / P^{.25}$$

Where:
A is the cross-sectional area and
P is the perimeter (or circumference)

Ontario Weather Data

Location	°C	Location	°C	Location	°C	Location	°C
Ailsa Craig	-17	Campbellford	-23	Elmvale	-24	Haliburton	-27
Ajax	-20	Cannington	-24	Embro	-19	Halton Hills (Georgetown)	-19
Alexandria	-24	Carleton Place	-25	Englehart	-33		
Alliston	-23	Cavan	-23	Espanola	-25	Hamilton	-17
Almonte	-26	Centralia	-17	Exeter	-17	Hanover	-19
Armstrong	-37	Chapleau	-35	Fenelon Falls	-25	Hastings	-24
Arnprior	-27	Chatham	-16	Fergus	-20	Hawkesbury	-25
Atikokan	-33	Chesley	-19	Forest	-16	Hearst	-35
Attawapiskat	-37	Clinton	-17	Fort Erie	-15	Honey Harbour	-24
Aurora	-21	Coboconk	-25	Fort Erie (Ridgeway)	-15	Hornepayne	-37
Bancroft	-28	Cobourg	-21			Huntsville	-26
Barrie	-24	Cochrane	-34	Fort Frances	-33	Ingersoll	-18
Barriefield	-22	Colborne	-21	Gananoque	-22	Iroquois Falls	-33
Beaverton	-24	Collingwood	-21	Geraldton	-36	Jellicoe	-36
Belleville	-22	Cornwall	-23	Glencoe	-16	Kapuskasing	-34
Belmont	-17	Corunna	-16	Goderich	-16	Kemptville	-25
Kitchenuhmay-koosib (Big Trout Lake)	-38	Deep River	-29	Gore Bay	-24	Kenora	-33
		Deseronto	-22	Graham	-35	Killaloe	-28
		Dorchester	-18	Gravenhurst (Muskoka Airport)	-26	Kincardine	-17
CFB Borden	-23	Dorion	-33			Kingston	-22
Bracebridge	-26	Dresden	-16			Kinmount	-26
Bradford	-23	Dryden	-34	Grimsby	-16	Kirkland Lake	-33
Brampton	-19	Dundalk	-22	Guelph	-19	Kitchener	-19
Brantford	-18	Dunnville	-15	Guthrie	-24	Lakefield	-24
Brighton	-21	Durham	-20	Haileybury	-32	Lansdowne House	-38
Brockville	-23	Dutton	-16	Haldimand (Caledonia)	-18		
Burk's Falls	-26	Earlton	-33			Leamington	-15
Burlington	-17	Edison	-34	Haldimand (Hagersville)	-17	Lindsay	-24
Cambridge	-18	Elliot Lake	-26			Lion's Head	-19

Location	°C	Location	°C	Location	°C	Location	°C
Listowel	-19	New Liskeard	-32	Pembroke	-28	Shelburne	-22
London	-18	Newcastle	-20	Penetanguishene	-24	Simcoe	-17
Lucan	-17	Newcastle (Bowmanville)	-20	Perth	-25	Sioux Lookout	-34
Maitland	-23			Petawawa	-29	Smiths Falls	-25
Markdale	-20	Newmarket	-22	Peterborough	-23	Smithville	-16
Markham	-21	Niagara Falls	-16	Petrolia	-16	Smooth Rock Falls	-34
Martin	-35	North Bay	-28	Pickering (Dunbarton)	-19		
Matheson	-33	Norwood	-24			South River	-27
Mattawa	-29	Oakville	-18	Picton	-21	Southampton	-17
Midland	-24	Orangeville	-21	Plattsville	-19	St. Catharine	-16
Milton	-18	Orillia	-25	Point Alexander	-29	St. Mary's	-18
Milverton	-19	Oshawa	-19	Port Burwell	-15	St. Thomas	-16
Minden	-27	Ottawa (Metropolitan)		Port Colborne	-15	Stirling	-23
Mississauga	-18			Port Elgin	-17	Stratford	-18
Mississauga (Lester B. Pearson Int'l Airport)	-20	Ottawa (City Hall)	-25	Port Hope	-21	Strathroy	-17
				Port Perry	-22	Sturgeon Falls	-28
		Ottawa (Barrhaven)	-25	Port Stanley	-15	Sudbury	-28
				Prescott	-23	Sundridge	-27
Mississauga (Port Credit)	-18	Ottawa (Kanata)	-25	Princeton	-18	Tavistock	-19
				Raith	-34	Temagami	-30
Mitchell	-18	Ottawa (M-C Int'l Airport)	-25	Rayside-Balfour (Chelmsford)	-28	Thamesford	-19
Moosonee	-36					Thedford	-16
Morrisburg	-23	Ottawa (Orleans)	-26	Red Lake	-35	Thunder Bay	-31
Mount Forest	-21			Renfrew	-27	Tillsonburg	-17
Nakina	-36	Owen Sound	-19	Richmond Hill	-21	Timmins	-34
Nanticoke (Jarvis)	-17	Pagwa River	-35	Rockland	-26	Timmins (Porcupine	-34
		Paris	-18	Sarnia	-16		
Nanticoke (Port Dover)	-15	Parkhill	-16	Sault Ste. Marie	-25	Toronto Metropolitan Region	
		Parry Sound	-24	Schreiber	-34		
Napanee	-22	Pelham (Fonthill)	-15	Seaforth	-17	Etobicoke	-20

Location	°C	Location	°C	Location	°C	Location	°C
North York	-20	Vaughan (Woodbridge)	-20	Wawa	-34	Wiarton	-19
Scarborough	-20			Welland	-15	Windsor	-16
Toronto (City Hall)	-18	Vittoria	-15	West Lorne	-16	Wingham	-18
		Walkerton	-18	Whitby	-20	Woodstock	-19
Trenton	-22	Wallaceburg	-16	Whitby (Brooklin)	-20	Wyoming	-16
Trout Creek	-27	Waterloo	-19				
Uxbridge	-22	Watford	-17	White River	-39		

EQUIPMENT SPECIFICATIONS

NOTE:
The specifications included in this section are generic in nature, and although they are representative of actual equipment, they may vary considerably from specific pieces of equipment experienced in the field.

For actual field calculations, the manufacturer's specifications for the equipment to be installed must be used.

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D L MANUFACTURING

Heat Recovery Ventilators

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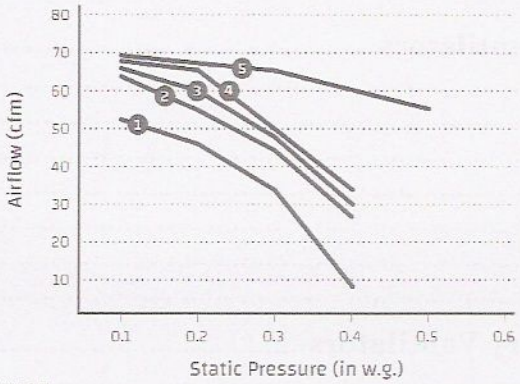
PERFORMANCE (HVI CERTIFIED)

IN. W.G. (PA)	0.1 (25) CFM (L/s)	0.2 (50) CFM (L/s)	0.3 (75) CFM (L/s)	0.4 (100) CFM (L/s)	0.5 (125) CFM (L/s)
Net Supply Airflow	68 (32)	66 (31)	64 (30)	59 (28)	55 (26)
Gross Supply Airflow	76 (36)	72 (34)	70 (33)	66 (31)	61 (29)
Gross Exhaust Airflow	87 (41)	85 (40)	83 (39)	78 (37)	76 (36)

ELECTRICAL SPECIFICATIONS	
VAC @ 60Hz	120
Watts / Low Speed	59
Watts / High Speed	89
Amp Rating	.9

Sensible Effectiveness (ASE) @ 60 CFM (28 L/s)	32°F (0°C)	88%
Sensible Efficiency (SRE) @ 60 CFM (28 L/s)	32°F (0°C)	75%
Sensible Efficiency (SRE) @ 71 CFM (33 L/s)	32°F (0°C)	73%
Sensible Efficiency (SRE) @ 61 CFM (29 L/s)	-13°F (-25°C)	68%



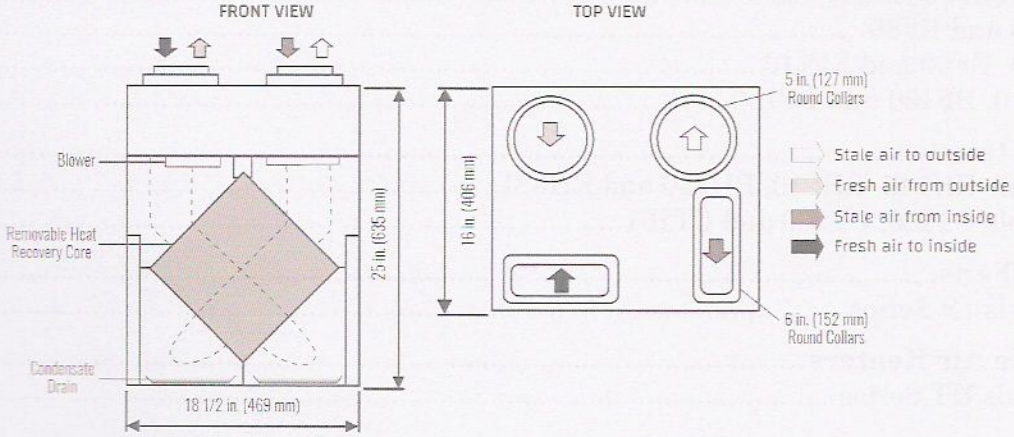
WEIGHT:
52 LBS (23.6 KG)

SHIPPING WEIGHT:
56 LBS (25.4 KG)

NOTE:
Front clearance of 25 in. (635 mm) is recommended for servicing unit. Round duct connections are 5 in. (127 mm) and oval collars use 6 in. (152 mm) connections.

Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	61	14.5	22.1

DIMENSIONS



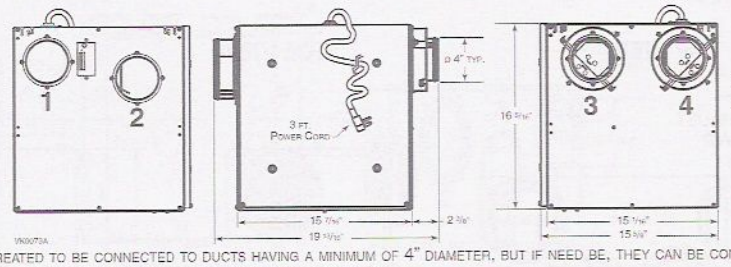
D L MANUFACTURING

Heat Recovery Ventilators

H77

DIMENSIONS: (SIDE PORTS)

1: FRESH AIR TO BUILDING PORT
2: EXHAUST AIR FROM BUILDING PORT



3: FRESH AIR FROM OUTSIDE PORT
4: EXHAUST AIR TO OUTSIDE PORT

NOTE: ALL UNITS PORTS WERE CREATED TO BE CONNECTED TO DUCTS HAVING A MINIMUM OF 4" DIAMETER, BUT IF NEED BE, THEY CAN BE CONNECTED TO BIGGER SIZED DUCTS BY USING AN APPROPRIATE TRANSITION (E.G.: 4" DIAMETER TO 5" DIAMETER TRANSITION).

VENTILATION PERFORMANCE

EXTERNAL STATIC PRESSURE		NET SUPPLY AIR FLOW			GROSS AIR FLOW					
					SUPPLY			EXHAUST		
PA	IN. W.G.	L/S	CFM	M^3/H	L/S	CFM	M^3/H	L/S	CFM	M^3/H
25	0.1	42	88	150	42	89	151	43	91	155
50	0.2	40	86	146	40	86	146	42	88	150
75	0.3	38	81	138	39	82	139	40	85	144
100	0.4	36	77	131	37	78	133	38	81	138
125	0.5	34	72	122	35	73	124	36	77	131
150	0.6	32	68	116	32	69	117	34	73	124
175	0.7	30	63	107	30	64	109	33	69	117
200	0.8	28	59	100	28	59	100	30	64	109

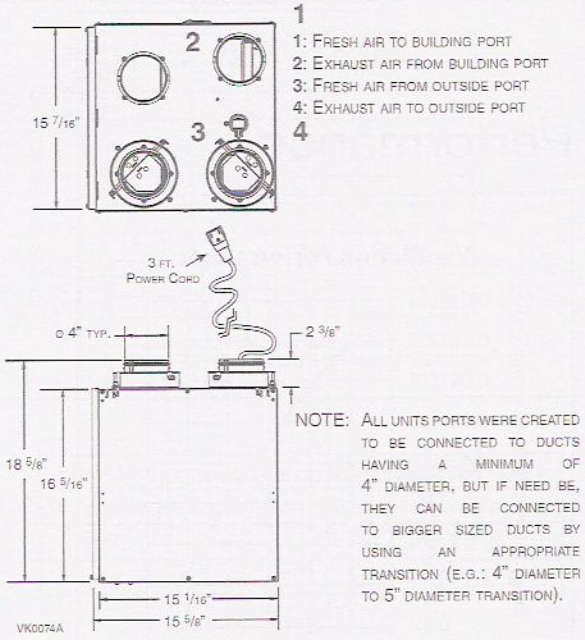
ENERGY PERFORMANCE

SUPPLY TEMPERATURE		NET AIR FLOW			POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT RECOVERY/ MOISTURE TRANSFER
°C	°F	L/S	CFM	M^3/H				
HEATING								
0	32	18	37	63	37	68	80	2
0	32	22	47	80	39	66	76	3
0	32	30	64	109	52	63	72	1
-25	-13	23	48	82	48	60	78	4
-25	-13	30	64	109	62	55	70	5

NOTE: All specifications are subject to change without notice.

Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	49	21.9	31.4
-25	64	16.4	21.9

(TOP PORTS)



1: FRESH AIR TO BUILDING PORT
2: EXHAUST AIR FROM BUILDING PORT
3: FRESH AIR FROM OUTSIDE PORT
4: EXHAUST AIR TO OUTSIDE PORT

NOTE: ALL UNITS PORTS WERE CREATED TO BE CONNECTED TO DUCTS HAVING A MINIMUM OF 4" DIAMETER, BUT IF NEED BE, THEY CAN BE CONNECTED TO BIGGER SIZED DUCTS BY USING AN APPROPRIATE TRANSITION (E.G.: 4" DIAMETER TO 5" DIAMETER TRANSITION).

D L MANUFACTURING

Heat Recovery Ventilators

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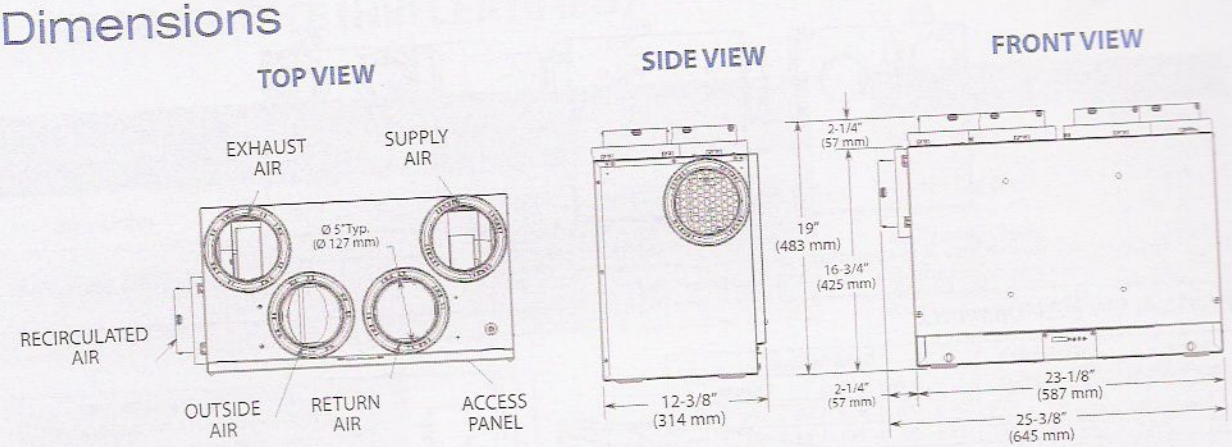
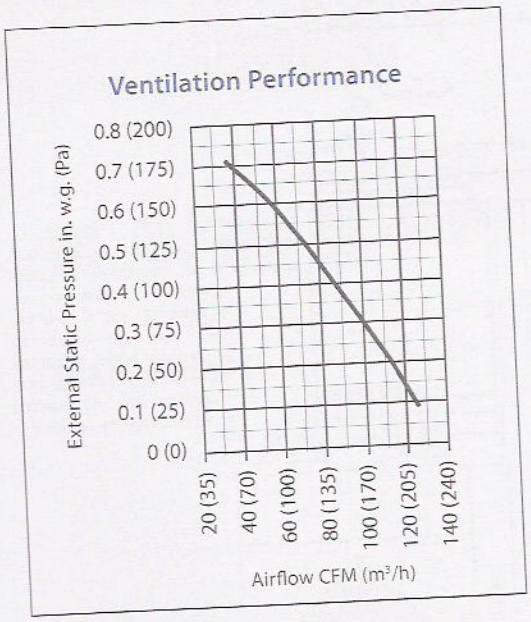
Dimensions



Performance



Recovery Performance						
Supply Temperature		Net Airflow		Power Consumed (W)	Sensible Recovery Efficiency	Apparent Sensible Effectiveness
°F	°C	CFM	L/s			
32	0	56	27	30	68%	75%
32	0	65	31	32	66%	72%
32	0	91	43	54	63%	69%
-13	-25	54	25	35	61%	83%
-13	-25	71	34	54	59%	75%

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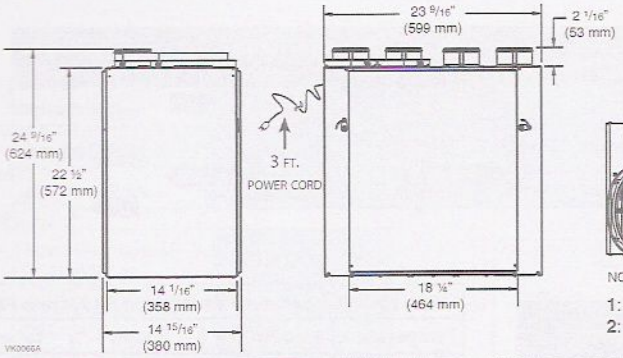
Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	68	17.0	30.0
-25	69	15.9	31.5

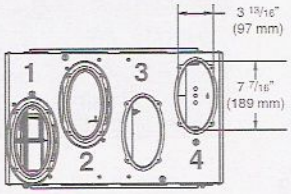
D L MANUFACTURING

Heat Recovery Ventilators

H155

Dimensions:





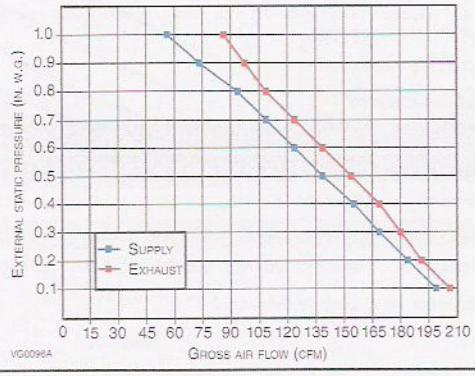
NOTE: Every port fits 6" round duct.

1: Exhaust air to outside port
2: Fresh air from outside port
3: Exhaust air from building port
4: Fresh air to building port

NOTE: All units ports were created to be connected to ducts having a minimum of 6" diameter, but if need be, they can be connected to bigger sized ducts by using an appropriate transition (e.g.: 6" diameter to 7" diameter transition).

Ventilation Performance

External Static Pressure		Net Supply Air Flow			Gross Air Flow					
					Supply			Exhaust		
Pa	in. w.g.	L/s	cfm	m^3/h	L/s	cfm	m^3/h	L/s	cfm	m^3/h
25	0.1	93	198	336	94	199	338	96	204	347
50	0.2	86	183	311	87	184	313	91	192	326
75	0.3	80	169	287	80	170	289	85	180	306
100	0.4	73	155	263	73	156	265	79	167	284
125	0.5	66	139	236	66	140	238	73	154	262
150	0.6	59	124	211	59	124	211	66	139	236
175	0.7	51	107	182	51	108	183	59	125	212
200	0.8	43	91	155	43	92	156	52	110	187
225	0.9	34	73	124	35	74	126	46	97	165
250	1.0	26	54	92	26	55	93	39	83	141



Energy Performance

Supply Temperature		Net Air Flow			Power consumed watts	Sensible recovery efficiency	Apparent sensible effectiveness	Latent recovery/ moisture transfer
°C	°F	L/s	cfm	m^3/h				
Heating								
0	32	31	65	110	54	75	83	0
0	32	40	84	143	66	73	80	0
0	32	55	116	197	90	69	76	0
-25	-13	30	64	109	72	70	84	0.05

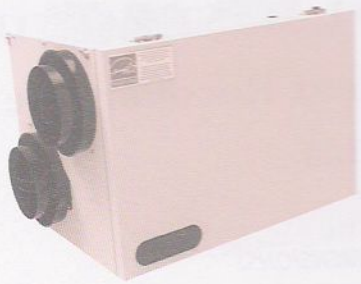
Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	64	11.7	17.5

NOTE: All specifications are subject to change without notice.

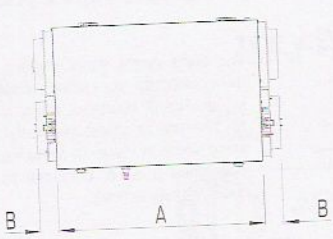
D L MANUFACTURING

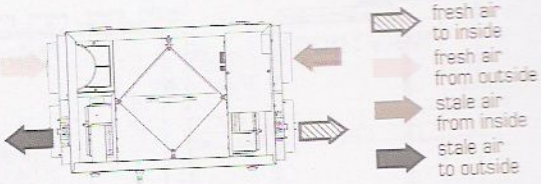
Heat Recovery Ventilators

H157



Dimensions & Airflow





Model	A		B		C		D	
	in	mm	in	mm	in	mm	in	mm
	23 3/4	604	2 1/8	55	17 1/4	438	16 1/4	414

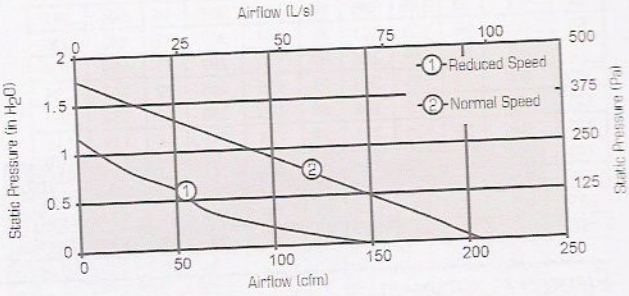
Clearance of 17" (432 mm) in front of the unit is recommended for removal of core. All units feature three foot plug-in power cord with 3-prong plug.

Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	89	12.0	15.9

Ventilation Performance

in.wg. (Pa)	0.2 (50)	0.4 (100)	0.6 (150)	0.8 (200)	1.0 (250)
	cfm (L/s)	cfm (L/s)	cfm (L/s)	cfm (L/s)	cfm (L/s)
Net supply airflow	181 (85)	157 (74)	134 (63)	111 (52)	87 (41)
Gross supply airflow	184 (87)	160 (76)	136 (64)	113 (53)	89 (42)
Gross exhaust airflow	184 (87)	160 (76)	136 (64)	113 (53)	89 (42)

Only the data of the normal speed are HVI certified.



Energy performance

Heating	Supply temperature		Net airflow		Consumed power	Sensible recovery efficiency	Apparent sensible effectiveness
	°F	°C	cfm	L/s	W	%	%
	32	0	85	40	70	66	79
	32	0	100	47	86	63	79
	32	0	187	88	156	55	64
	-13	-25	89	42	99	60	72

Requirements and standards

- Complies with the UL 1812 requirements regulating the construction and installation of Heat Recovery Ventilators
- Complies with the CSA C22.2 no. 113 Standard applicable to ventilators
- Complies with the CSA F326 requirements regulating the installation of Heat Recovery Ventilators
- Technical data was obtained from published results of test relating to CSA C439 Standards
- HVI certified and ENERGY STAR® qualified*

* This product earned the ENERGY STAR® by meeting strict efficiency guidelines set by Natural Resources Canada and the US EPA. It meets ENERGY STAR® requirements only when used in Canada.

D L MANUFACTURING

Heat Recovery Ventilators

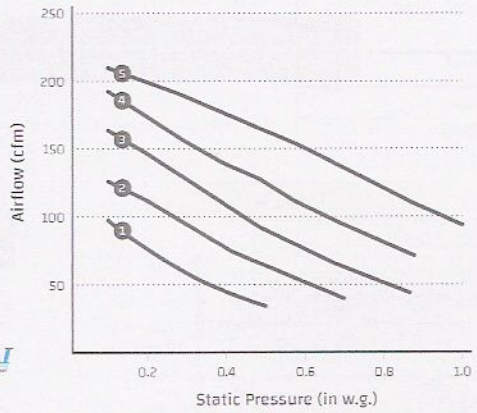
H172

PERFORMANCE (HVI CERTIFIED)

IN. W.G. (PA)	0.1 (25) CFM (L/s)	0.2 (50) CFM (L/s)	0.3 (75) CFM (L/s)	0.4 (100) CFM (L/s)	0.5 (125) CFM (L/s)	0.6 (150) CFM (L/s)	0.7 (175) CFM (L/s)
Net Supply Airflow	203 (96)	193 (91)	182 (86)	172 (81)	159 (75)	148 (70)	136 (64)
Gross Supply Airflow	208 (98)	197 (93)	186 (88)	174 (82)	163 (77)	150 (71)	138 (65)
Gross Exhaust Airflow	212 (100)	199 (94)	186 (88)	172 (81)	159 (75)	144 (68)	129 (61)

ELECTRICAL SPECIFICATIONS	
VAC @ 60Hz	120
Watts / Low Speed	64
Watts / High Speed	96
Amp Rating	1.4

Sensible Effectiveness (ASE) @ 64 CFM (30 L/s)	32°F (0°C)	85%
Sensible Efficiency (SRE) @ 64 CFM (30 L/s)	32°F (0°C)	76%
Sensible Efficiency (SRE) @ 100 CFM (47 L/s)	32°F (0°C)	73%
Sensible Efficiency (SRE) @ 102 CFM (48 L/s)	-13°F (-25°C)	70%

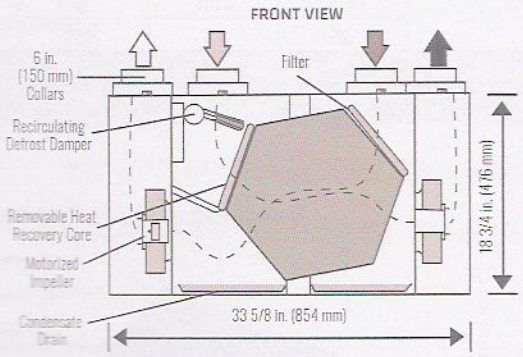


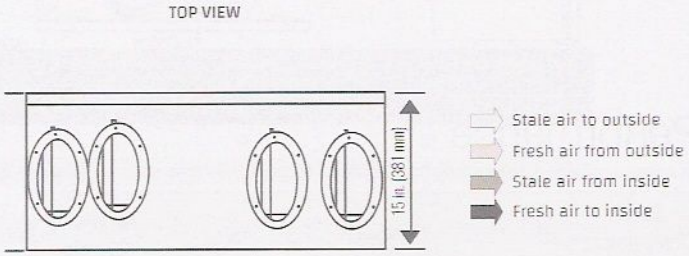
WEIGHT:
57 LBS (25.8 KG)

SHIPPING WEIGHT:
67 LBS (30 KG)

NOTE:
Front clearance of 25 in. (635 mm) is recommended for servicing unit. All ducts use 5 in. (125 mm) round collars.

DIMENSIONS





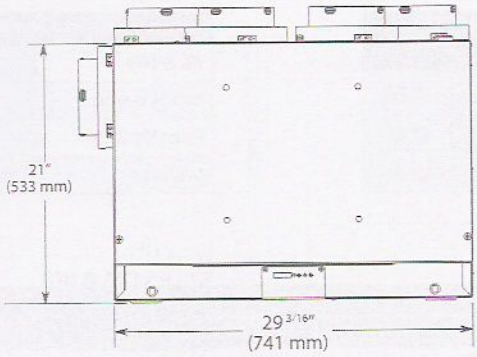
Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	102	10.3	17.1

D L MANUFACTURING

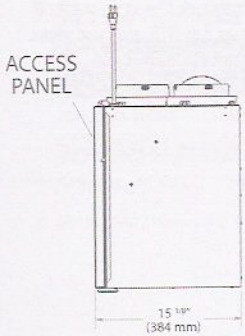
Heat Recovery Ventilators

H200

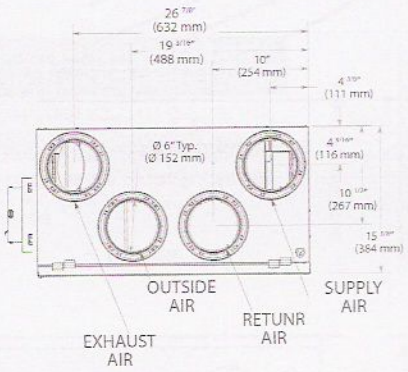
FRONT VIEW



SIDE VIEW



TOP VIEW

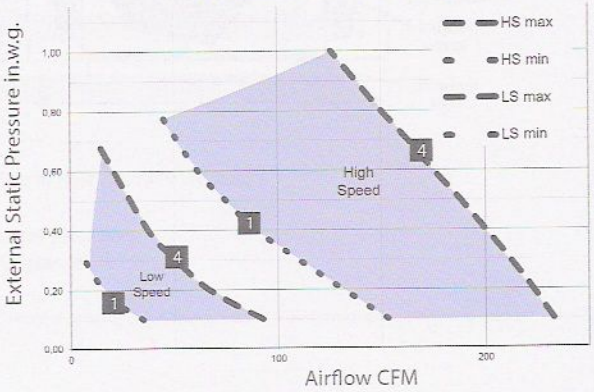


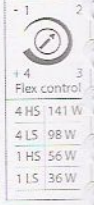
Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	74	21.8	30.7

Performance

Supply Temperature		Net Airflow		Power Consumed (W)	Sensible Recovery Efficiency	Adjusted Sensible Recovery Efficiency
°F	°C	CFM	L/s			
32	0	64	30	68	75%	82%
32	0	81	38	70	74%	80%
32	0	120	57	110	68%	75%
-13	-25	74	35	84	66%	70%

Ventilation Performance





Intertek
C22.2 no113
UL 1812

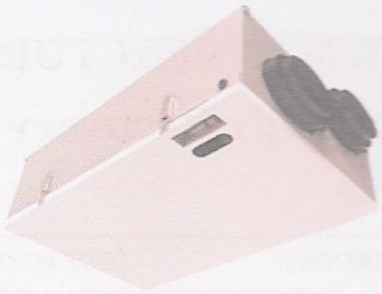
2100 HVI CERTIFIED

ENERGY STAR

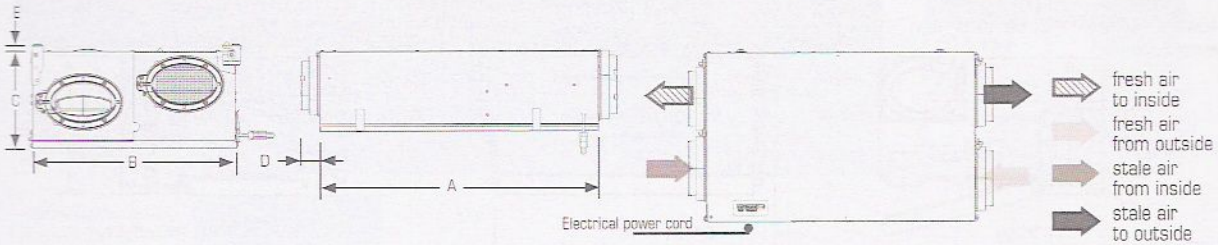
D L MANUFACTURING

Enthalpy Recovery Ventilators

E102



Dimensions & Airflow

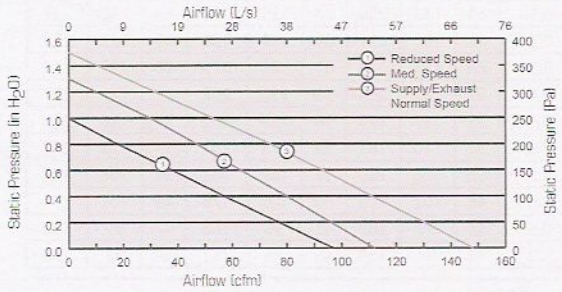


Model	A		B		C		D		E	
	in	mm	in	mm	in	mm	in	mm	in	mm
	30 1/2	775	19	485	8 3/4	222	2	51	1/2	14

Clearance of 8" (203 mm) in front of the unit is recommended for removal of core. All units feature three foot plug-in power cord with 3-prong plug.

Ventilation Performance

in.wg. (Pa)	0.2 (50)	0.4 (100)	0.6 (150)	0.8 (200)
	cfm (L/s)	cfm (L/s)	cfm (L/s)	cfm (L/s)
Net supply airflow	125 (59)	106 (50)	89 (42)	70 (33)
Gross supply airflow	129 (61)	110 (52)	93 (44)	74 (35)
Gross exhaust airflow	129 (61)	110 (52)	93 (44)	74 (35)



Energy performance

Heating	Supply temperature		Net airflow		Consumed power	Sensible recovery efficiency	Apparent sensible effectiveness	Latent recovery/moisture transfer
	°F	°C	cfm	L/s	W	%	%	%
	32	0	65	31	82	65	85	55
	32	0	85	40	112	64	80	50
	32	0	98	46	148	63	78	48
	5	-15	66	31	82	56	80	45
Cooling	95	35	47	22	82		45[1]	

[1] Total recovery efficiency

Requirements and standards

- Complies with the UL 1812 requirements regulating the construction and installation of Heat Recovery Ventilators
- Complies with the CSA C22.2 no. 113 Standard applicable to ventilators
- Complies with the CSA F326 requirements regulating the installation of Heat Recovery Ventilators
- Technical data was obtained from published results of test relating to CSA C439 Standards
- ERV Core ISO 846 certified for mold and bacteria resistance
- HVI certified

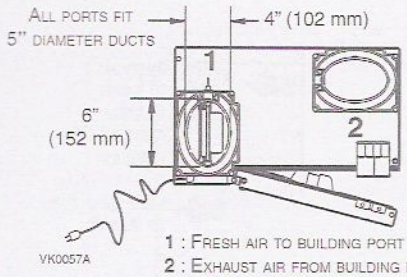
Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	66	9.1	16.1

D L MANUFACTURING

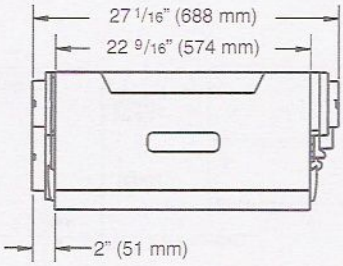
Enthalpy Recovery Ventilators

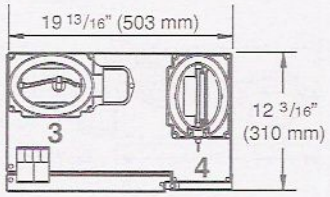
E120

DIMENSIONS: (SIDE PORTS)



1 : FRESH AIR TO BUILDING PORT
2 : EXHAUST AIR FROM BUILDING PORT





3 : FRESH AIR FROM OUTSIDE PORT
4 : EXHAUST AIR TO OUTSIDE PORT

VENTILATION PERFORMANCE

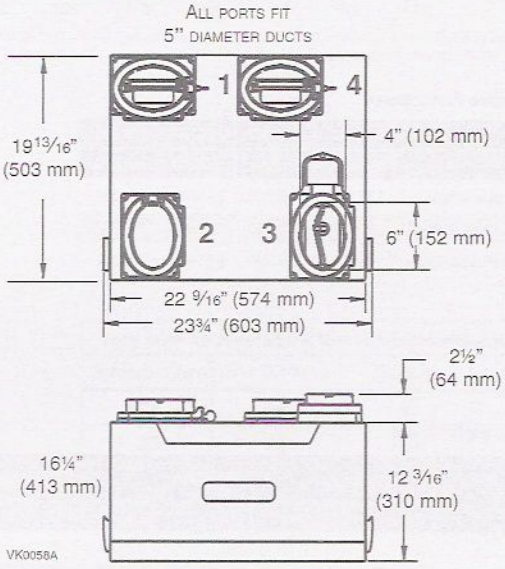
EXTERNAL STATIC PRESSURE		NET SUPPLY AIR FLOW			GROSS AIR FLOW					
					SUPPLY			EXHAUST		
PA	IN. W.G.	L/S	CFM	M^3/H	L/S	CFM	M^3/H	L/S	CFM	M^3/H
25	0.1	63	133	226	64	136	231	64	136	231
50	0.2	61	130	221	63	133	226	62	132	224
75	0.3	60	126	214	61	129	219	60	127	216
100	0.4	57	120	204	58	122	207	58	122	207
125	0.5	55	117	199	56	119	202	56	118	200
150	0.6	52	110	187	53	113	192	53	113	192
175	0.7	50	106	180	51	108	183	51	108	183
200	0.8	48	102	173	50	105	178	48	101	171
225	0.9	46	98	167	47	99	168	47	99	168
250	1.0	44	93	158	45	95	161	44	93	158

ENERGY PERFORMANCE

SUPPLY TEMPERATURE		NET AIR FLOW			POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT RECOVERY/ MOISTURE TRANSFER
°C	°F	L/S	CFM	M^3/H				
HEATING								
0	32	23	49	83	42	67	79	0.61
0	32	30	64	109	60	65	75	0.55
0	32	40	84	143	72	63	71	0.48
-25	-13	23	49	83	58	60	75	0.60
-25	-13	30	64	109	71	55	71	0.57
COOLING						TOTAL RECOVERY EFFICIENCY		
35	95	21	44	75	42	50		

Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	49	27.7	21.9
-25	64	26.3	22.1

(TOP PORTS)



1 : FRESH AIR TO BUILDING PORT
2 : EXHAUST AIR FROM BUILDING PORT
3 : FRESH AIR FROM OUTSIDE PORT
4 : EXHAUST AIR TO OUTSIDE PORT

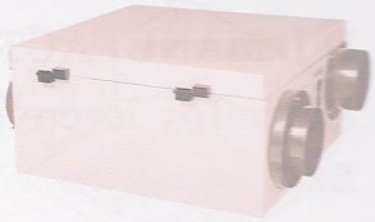
NOTE: All specifications are subject to change without notice.

HVI CERTIFIED · HRAI MEMBER · ENERGY STAR PARTICIPANT · c UL us

D L MANUFACTURING

Enthalpy Recovery Ventilators

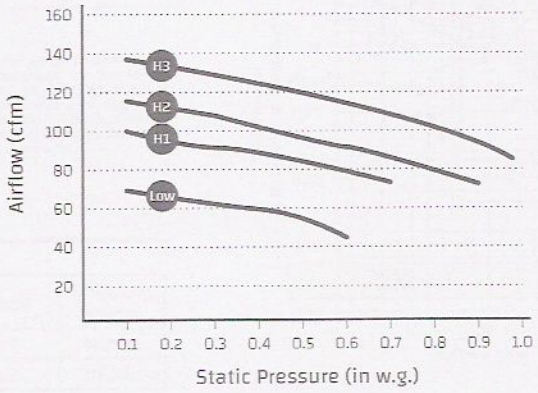
E125



IN. W.G. (PA)	0.2 (50) CFM (L/s)	0.3 (75) CFM (L/s)	0.4 (100) CFM (L/s)	0.5 (125) CFM (L/s)	0.6 (150) CFM (L/s)	0.7 (175) CFM (L/s)	0.8 (200) CFM (L/s)	0.9 (225) CFM (L/s)
Net Supply Airflow	133 (63)	129 (61)	125 (59)	119 (56)	114 (54)	108 (51)	102 (48)	93 (44)
Gross Supply Airflow	136 (64)	131 (62)	127 (60)	121 (57)	117 (55)	110 (52)	102 (48)	93 (44)
Gross Exhaust Airflow	133 (63)	129 (61)	125 (59)	121 (57)	114 (54)	110 (52)	104 (49)	95 (45)

ELECTRICAL SPECIFICATIONS	
VAC @ 60Hz	120
Watts / Low Speed	60
Watts / High Speed	154
Amp Rating	1.4

Sensible Effectiveness (ASE) @ 49 CFM (23 L/s)	32°F (0°C)	83%
Sensible Efficiency (SRE) @ 66 CFM (30 L/s)	32°F (0°C)	71%
Sensible Efficiency (SRE) @ 49 CFM (23 L/s)	32°F (0°C)	72%
Total Efficiency (TRE) @ 64 CFM (30 L/s)	95°F (35°C)	45%

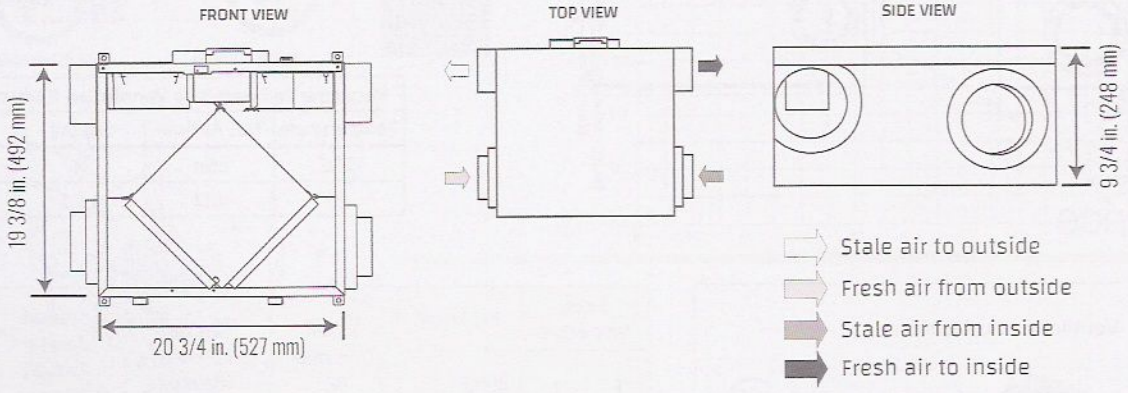


WEIGHT:
34 LBS (15.5 KG)

SHIPPING WEIGHT:
36 LBS (16 KG)

NOTE:
Front clearance of 25 in. (635 mm) is recommended for servicing unit.

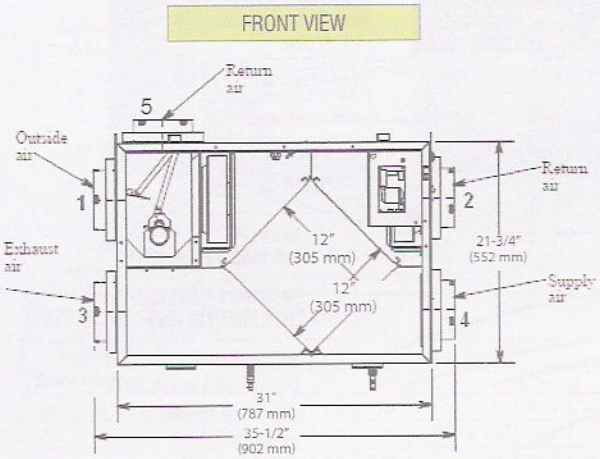
DIMENSIONS

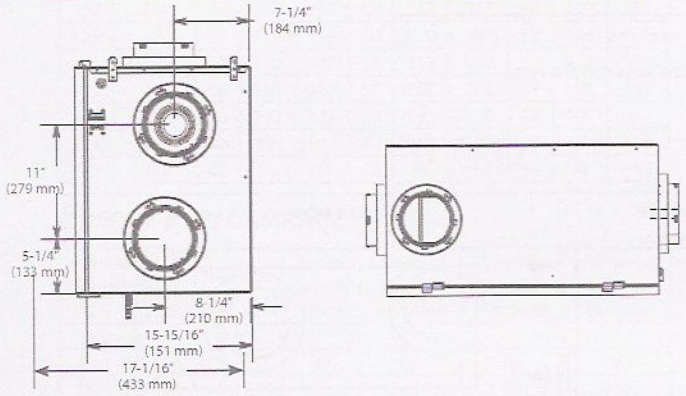


D L MANUFACTURING

Enthalpy Recovery Ventilators

E240





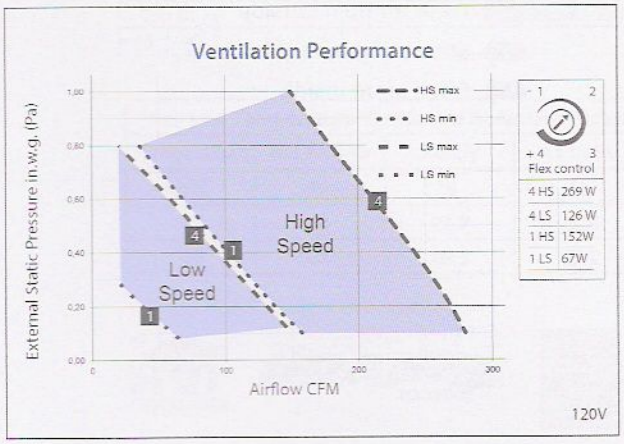
Intertek
C22.2 no113
UL 1812

2100 HVI CERTIFIED

ENERGY STAR

Very Low Temperature Ventilation Reduction Factor			
Temperature	Net Airflow	Supply	Exhaust
@°C	cfm	%	%
-25	107	14.1	20.5

Performance

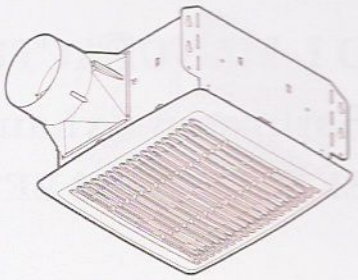


Supply Temperature		Net Airflow		Power Consumed (W)	Sensible Recovery Efficiency	Adjusted Sensible Recovery Efficiency	Latent Recovery
°F	°C	CFM	L/s				
Heating							
32	0	64	30	84	77%	86%	0.73
32	0	81	38	94	76%	84%	0.69
32	0	121	57	146	72%	80%	0.60
-13	-25	67	31	107	70%	75%	0.68
Cooling					TRE	ATRE	
95	35	81	38	94	57	62	0.58

D L MANUFACTURING

Bathroom Exhaust Fans

EF50 and EF80



HVI PERFORMANCE

Model	0.1 Ps - Static Pressure (in H_2O)				0.25 Ps
	Airflow (CFM)	Sound (Sones)	Power (Watts)	Efficacy (CFM / W)	Airflow (CFM)
EF50	50	0.5	20.0	3.55	37
EF80	80	1.5	26.9	2.97	60

HVI-2100 CERTIFIED RATINGS comply with new testing technologies and procedures prescribed by the Home Ventilating Institute, for off-the-shelf products, as they are available to consumers. Product performance is rated at 0.1 in. static pressure, based on tests conducted in a state-of-the-art test laboratory. Sones are a measure of humanly-perceived loudness, based on laboratory measurements.

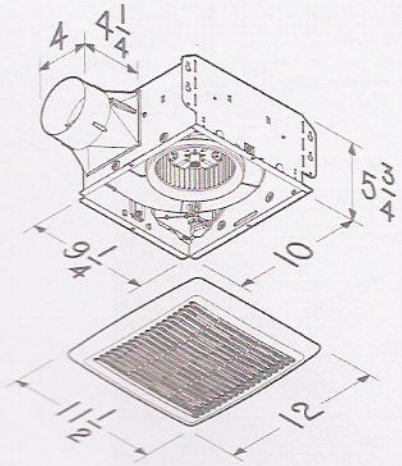
ELECTRICAL & WEIGHT

Model	Volts	Hz	Amps	Shipping Weight
EF50	120	60	0.2	10.0 lb.
EF80	120	60	0.3	10.0 lb.

Model EF80

Models EF50

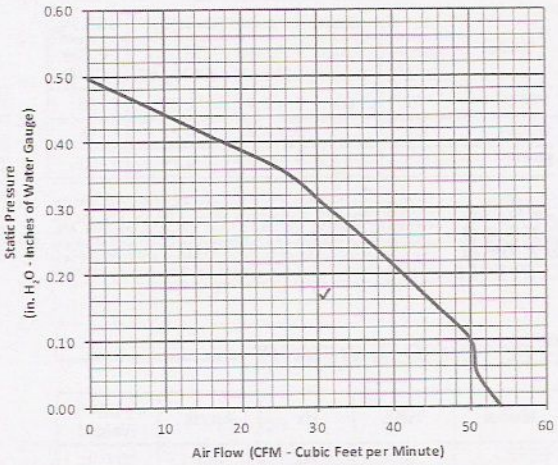
ENERGY STAR



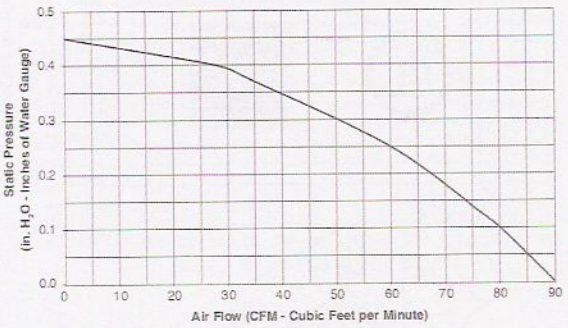
NOTE: Dimensions shown are in inches.

AIR FLOW PERFORMANCE

Model EF50 :



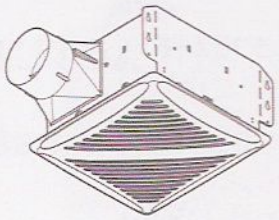
Models EF80



D L MANUFACTURING

Bathroom Exhaust Fans

EF70, EF90 and EF110



HVI PERFORMANCE

Model	0.1 Ps - Static Pressure (in. H_2O)				0.25 Ps
	Airflow (CFM)	Sound (Sones)	Power (Watts)	Efficacy (CFM / W)	Airflow (CFM)
EF70	70	0.8	26.9	2.97	53
EF90	90	1.0	23.4	4.71	75
EF110	110	1.0	23.4	4.71	92

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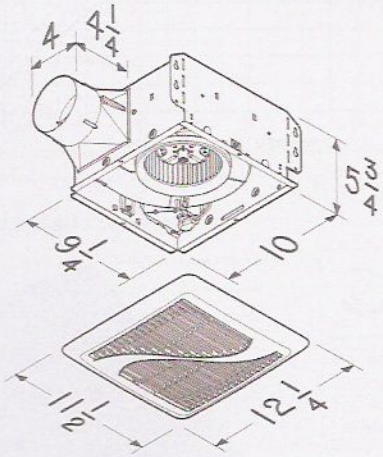
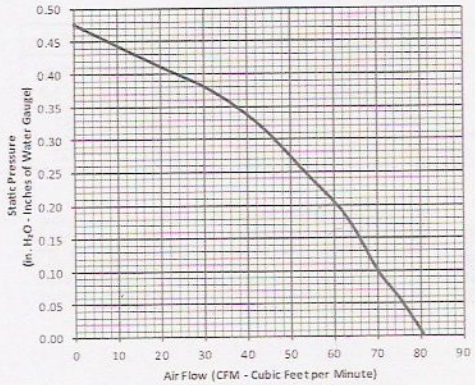
ELECTRICAL & WEIGHT

Model	Volts	Hz	Amps	Shipping Weight
EF70	120	60	0.3	10.0 lb.
EF90	120	60	0.3	10.0 lb.
EF110	120	60	0.3	10.0 lb.

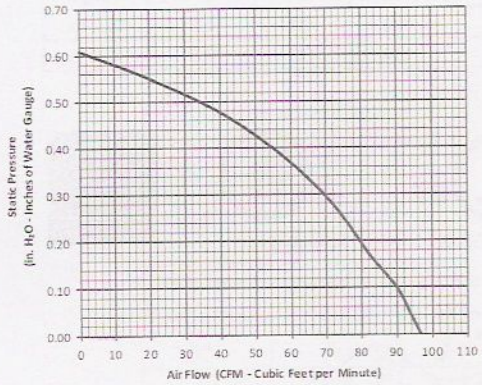


NOTE: Dimensions shown are in inches.

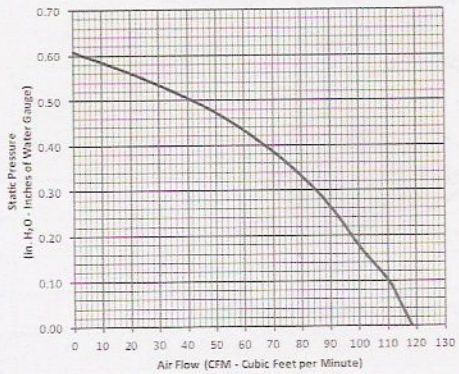
Model EF70



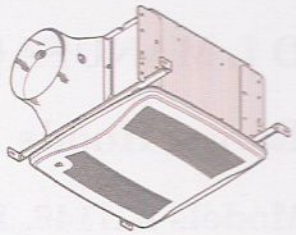
Model EF90



Model EF110



D L MANUFACTURING
Bathroom Exhaust Fans
BF110, BF130 and BF150



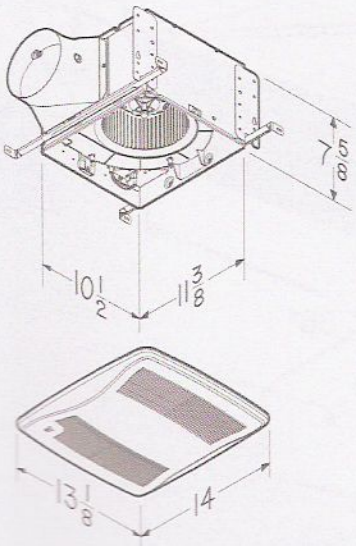
HVI PERFORMANCE

Speed Setting	Static Pressure (In. H2O)	Airflow (CFM)	Sound (Sones)	Power (Watts)	Efficacy (CFM/W)
BF110	0.1	110	< 0.3	8.3	13.8
	0.25	91	0.9	12.0	7.9
BF130	0.1	130	0.4	10.3	12.8
	0.25	130	1.2	17.7	7.4
BF150	0.1	150	0.7	13.9	11.0
	0.25	144	1.4	21.1	6.9

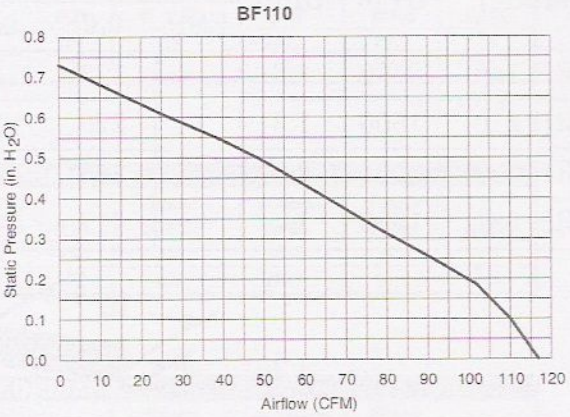
HVI-2100 CERTIFIED RATINGS comply with new testing technologies and procedures prescribed by the Home Ventilating Institute, for off-the-shelf products, as they are available to consumers. Product performance is rated at 0.1 in. static pressure, based on tests conducted in a state-of-the-art test laboratory. Sones are a measure of humanly-perceived loudness, based on laboratory measurements.

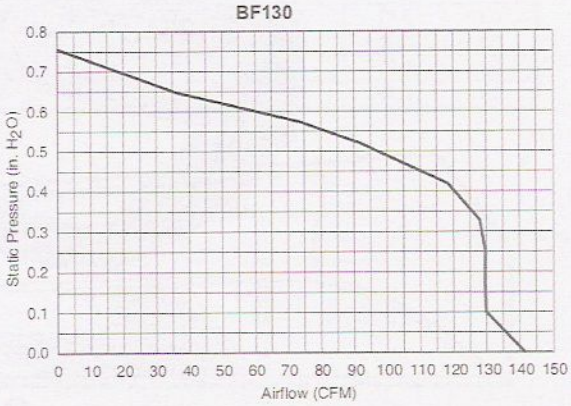
ELECTRICAL & WEIGHT

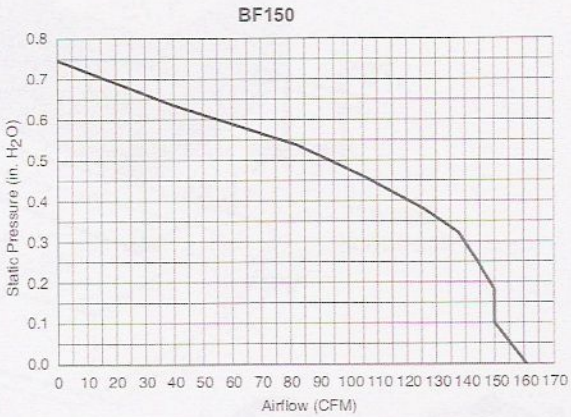
Volts	Hz	Amps	Shipping Weight
120	60	0.5	12.4 lbs.



AIR FLOW PERFORMANCE





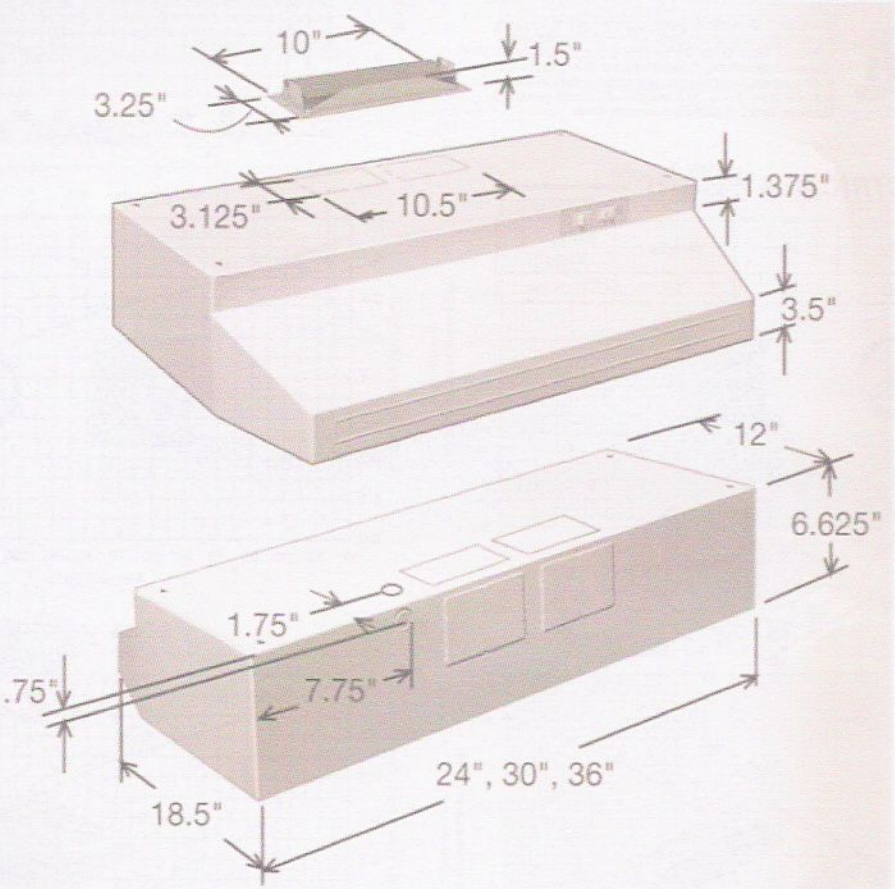


D L MANUFACTURING

Range Hoods

Models RH146, RH210, RH230 and RH381

Model	RPM	Amps	CFM						Sones
			ESP	0.0	0.1	0.2	0.3	0.4	0.5	
RH 146	2400	1.3		173	146	100	61	20		8.5
RH 210	1500	1.3		229	210	196	165	101		5.0
RH 230	2200	2.0		263	230	200	162	112	40	11.0
RH 381	1500	2.4		417	381	343	304	259	190	6.5



D L MANUFACTURING

Range Hoods

Models CT180, CT200 and CT261

Model CT180

EXPANDED PERFORMANCE										
	Static Pressure (inches of w.g.)						Sones	Fan Speed	Power	
Air Flow - CFM	0	0.05	0.1	0.15	0.2	0.25	@ .1 SP	RPM	Watts	Apms
Vertical Ducting High	246	232	218	203	181	147	7.5	2973	87.0	2.1
Horizontal Ducting High	225	210	180	175	155	120	7.0	3024	87.0	2.1

Model CT200

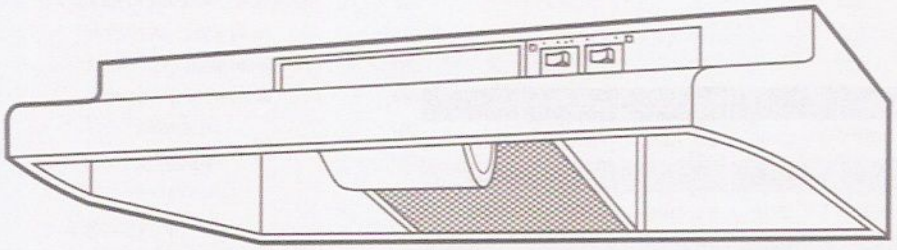
EXPANDED PERFORMANCE										
	Static Pressure (inches of w.g.)						Sones	Fan Speed	Power	
Air Flow - CFM	0	0.05	0.1	0.15	0.2	0.25	@ .1 SP	RPM	Watts	Apms
Vertical Ducting	233	218	200	181	158	132	6.5	2847	91.0	1.5
Horizontal Ducting	233	218	200	181	158	132	6.5	2847	91.0	1.5

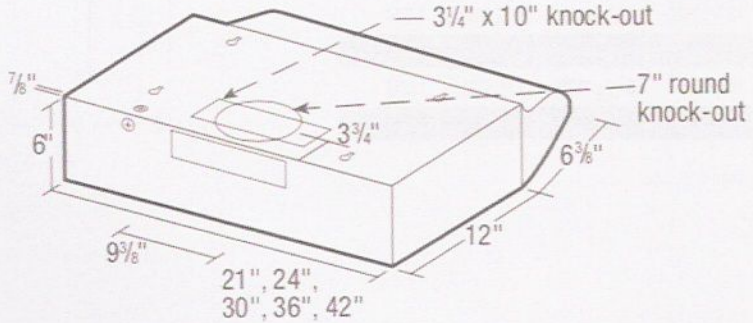
Model CT261

EXPANDED PERFORMANCE										
	Static Pressure (inches of w.g.)						Sones	Fan Speed	Power	
Air Flow - CFM	0	0.1	0.125	0.15	0.2	0.25	@ .1 SP	RPM	Watts	Amps
Horz Ducting High Speed	311	270	261	251	225	188	4.0	1653	73.0	1.0
Horz Ducting Low Speed	163	150	144	137	66	-	1.5	1229	41.0	1.0
Vert Ducting High Speed	310	270	261	251	225	192	4.0	1653	73.0	1.0
Vert Ducting Low Speed	159	150	148	142	114	44	1.5	1189	41.3	1.0

Intertek

2100 HVI CERTIFIED





D L MANUFACTURING

Inline Fans

Models IN Series

Specification Data

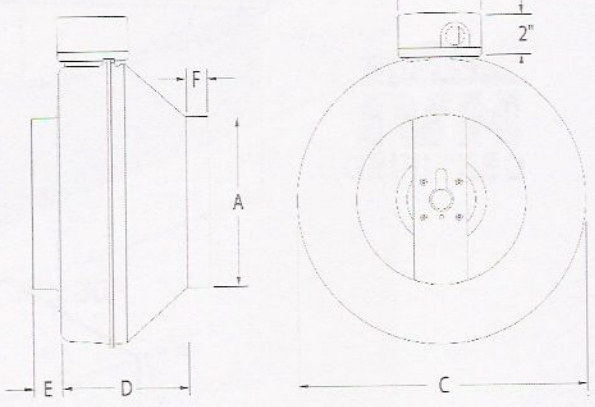
Model		Rated power	Voltage / phase	Max amps	RPM	0.0" P_s	0.2" P_s	0.4" P_s	0.6" P_s	0.8" P_s	1.0" P_s	1.5" P_s	Max P_s	Shipping weight	
		W	V / ~	A	min^{-1}	cfm							in.wg	lbs	kg
IN110	•	20	120/1	0.19	3000	135	110	83	55	25	-	-	0.94	7	3
IN150		71	120/1	0.66	2700	170	150	134	119	103	86	40	1.98	8	4
IN130	•	20	120/1	0.19	3000	156	130	99	66	33	-	-	0.99	7	3
IN190		73	120/1	0.68	2700	220	190	160	135	112	91	41	1.89	8	4
IN287	•	72	120/1	0.58	2700	303	287	270	232	196	164	58	1.88	10	5
IN370		120	120/1	1.02	2350	418	370	317	268	224	186	101	2.10	12	5
IN450		153	120/1	1.48	2900	463	450	409	369	329	289	201	2.41	12	5
IN410		119	120/1	1.14	2550	461	410	351	295	243	191	97	2.11	12	5
IN470		142	120/1	1.45	2950	502	470	428	388	351	313	218	2.40	13	6
IN480		138	120/1	1.43	3000	513	480	444	407	366	324	216	2.36	12	5
IN560		196	120/1	1.96	3100	589	560	531	503	472	441	355	3.02	14	6
IN660		181	120/1	1.87	2600	741	680	601	515	434	363	236	2.99	18	7
IN880		301	120/1	3.01	2900	940	880	819	746	670	596	425	2.74	21	10

Performance shown is for installation type D - Duct inlet, Ducted outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test. Performance ratings do not include the effects of appurtenances (accessories).

Dimensions

Model	A	C	D	E	F
IN110	4 (102)	8 1/2 (216)	6 1/2 (165)	1 (25)	1 (25)
IN150	4 (102)	9 3/4 (248)	6 15/16 (176)	1 (25)	1 (25)
IN130	5 (127)	8 5/8 (219)	6 1/2 (165)	1 (25)	1 (25)
IN190	5 (127)	9 3/4 (248)	6 (152)	1 1/8 (29)	1 1/8 (29)
IN287	6 (152)	11 3/8 (289)	6 1/4 (159)	1 (25)	7/8 (22)
IN370/IN450	6 (152)	13 1/8 (333)	7 (178)	1 (25)	1 (25)
IN410	8 (203)	13 1/4 (337)	6 (152)	1 (25)	1 (25)
IN470	8 (203)	13 1/4 (337)	6 (152)	1 1/8 (29)	1 (25)
IN480	10 (254)	13 1/4 (337)	4 3/4 (121)	1 1/8 (29)	1 (25)
IN560	10 (254)	13 1/4 (337)	4 13/16 (122)	1 1/4 (32)	1 (25)
IN660	12 (305)	16 (406)	6 11/16 (170)	1 1/4 (32)	1 (25)
IN880	12 (305)	16 (406)	6 11/16 (170)	1 1/2 (38)	1 (25)

All dimensions in inches (mm).
†Duct connection is 1/8" smaller than duct size.

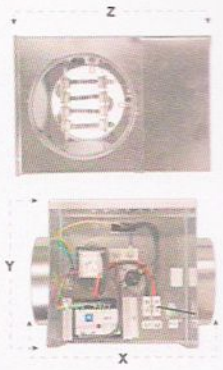


D L MANUFACTURING

Outside Air Heaters

Models HT Series

- ☐ NEW EXPANDED RANGE
- ☐ CAPACITIES FROM 1 to 12 KW
- ☐ FITS FROM 5" TO 12" DIAMETER DUCTS
- ☐ BUILT-IN ADJUSTABLE ELECTRONIC DUCT SENSOR 0°C to 42°C (32°F to 108°F)
- ☐ JUST ONE ELECTRICAL CONNECTION AND THE UNIT IS READY TO PERFORM



Available Stock Models | Frame Size

Model	KW	Voltage / Amps	Minimum CFM	X dimension in Inches	Y dimension in Inches	Z dimension in Inches
HT01	1	240V/4.2A : 208V/4.8A : 120V/8.3A	30	11.5	8	11.5
HT02	2	240V/8.3A : 208V/9.6A : 120V/16.7A	60	11.5	8	11.5
HT03	3	240V/12.5A : 208V/14.4A	90	11.5	10	13.5
HT04	4	240V/16.7A : 208V/19.2A	120	11.5	10	13.5
HT05	5	240V/20.8A : 208V/24.0A	150	11.5	10	13.5
HT06A	6	240V/25.0A	180	11.5	10	13.5
HT06B	6	240V/25.0A	180	15.5	12	15.5
HT08	8	240V/33.3A	240	15.5	12	15.5
HT10	10	240V/41.6A	300	15.5	12	15.5
HT12	12	240V/47.9A (11.5 KW)	345	15.5	12	15.5